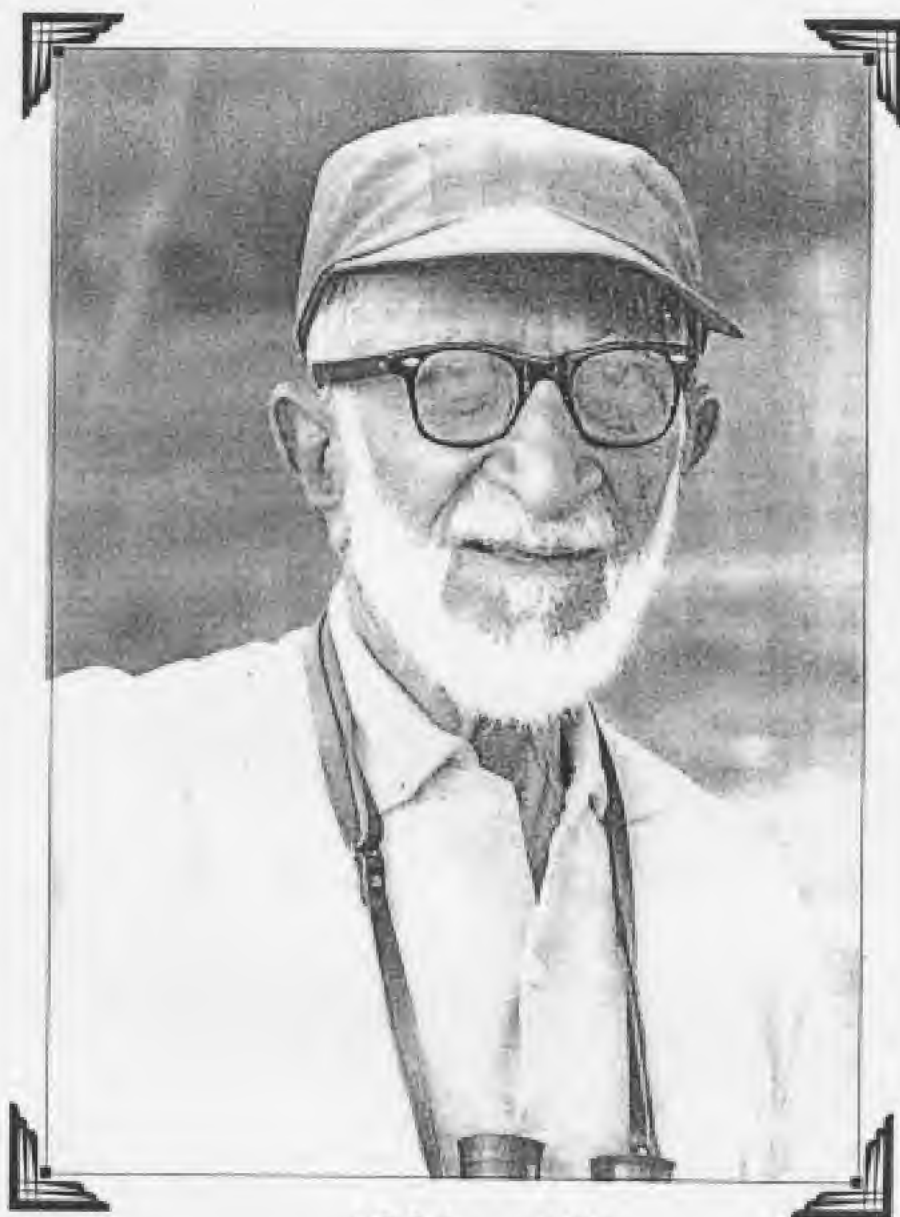


# Annual Report 1998-99



Salim Ali Centre for Ornithology & Natural History



1896 - 1987

*"Thy dream is being fulfilled"*  
!!

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## **BACKGROUND**

One of the long-cherished dreams of late Dr Salim Ali was to establish a national centre for studies in Ornithology and Natural History. This was fulfilled in 1990, thanks to the incessant efforts of the Bombay Natural History Society (BNHS), the country's oldest NGO, and the financial assistance of the Ministry of Environment & Forests (MoEF), Government of India. The centre befittingly named as Salim Ali Centre for Ornithology and Natural History (SACON), is an autonomous organization registered under the Society's Registration Act 1860.

SACON came into being at a time when the twin issues, namely the sustainable use and conservation of natural resources figured in the global agenda. Realizing the indispensability of holistic approach in avian studies and conservation, the major objectives of SACON have been envisaged encompassing the entire natural history with ornithology at the centre stage.

The management of SACON is vested on a Governing Council comprising 15 members with its Chairman nominated by the BNHS. The SACON Society has 61 members and its President is automatically the same as that of BNHS.



## 1998-1999 – AN OVERVIEW

The year 1998-'99 is significant to SACON. It is during this period that SACON could move to its own permanent campus, in the sylvan settings of Anaikatty at the fringes of the Nilgiri Biosphere Reserve in the Western Ghats. It was a welcome relief from the small buildings at Kalampalayam where we were cramped for space for the last six years. The unpolluted air, the greenery, the rolling hills and, above all the chirps of babblers, the musical 'tweet' of bushchats, the melodious notes of Magpie-Robins, the lively rattling notes of Whitebrowed Bulbuls made the SACON team feel at home. It is our true habitat for which we were longing for.

Adding to this splendid atmosphere, is the working space and comfort of the buildings offered by the ingenuity of the celebrated architect, Mr Laurie Baker. The workspace is so designed that it has natural light and wind, the latter often more than required! It is more satiating that the buildings stand a testimony to SACON's philosophy of austerity and environment friendly activities.

The heartening atmosphere of the premises rejuvenated the staff. Many projects started in 1994 could be completed, and many could be commissioned during the year, and ideas floated for new, seeking funds from various sources.

The endangered species programme came up with sound scientific recommendations for the conservation of the Andaman Teal, an endemic endangered species with around 550 birds, Narcondam Hornbill, another endangered endemic species with a population of around 300 and Nicobar Megapode, the only bird species which do not incubate their eggs but leave them to the geothermic or heat generated by rotting vegetation for incubation. The recommendations have been well received by the local management authorities and are being implemented.

The Lesser Florican conservation programmes, mainly the Florican Watch organised by SACON seem to have taken a permanent root in Western India. The reports on the population of breeding florican and the habitat protection, especially of the grass *beds* are heartening, as these consummate with our efforts.

Compilation on the distribution of the endangered taxa of reptiles and amphibians in the Protected Areas brings out shocking results to the managers and conservationists, as only 32% of them are in the present PAs. The rest are outside. It further exposes the widely considered view that flag-ship conservation (Tiger and Elephant) would take care of the entire biodiversity. It calls for an immediate assessment of the status of lower vertebrates and also invertebrates in the existing PAs.

Biodiversity in fragmented forests faces serious conservation problems. The rate of extinction due to fragmentation is more in habitat specialists such as Lion-tailed Macaque, Nilgiri Langur and the Malabar Spiny Dormouse, all endemics to the Western Ghats. Non-endemics and commensal species thrive well in fragments. Amphibians and reptiles show low alpha diversity, inspite of their higher diversity in the Western Ghats. Species assemblages of Amphibians vary from drainage to drainage, whereas in reptiles it does so according to altitudes.

SACON could demonstrate the success of a conservation programme where local people were an integral part of the scheme. Alternative livelihood of their choice when offered, they resisted the tendency to turn to the forest for sustenance.

In spite of the large quantum of pesticides being used and a very high quantity of industrial effluents released into the rivers, it is quite relieving to note that the level of pesticides in fishes and a few species of birds studied was low and much below the lethal level in the Nilgiris District. So is the case with the metal contamination also. However, concentration of pesticides and metals even in low concentrations for a longer period may cause deleterious effects.

Anthropogenic pressures in the existing forests in the Nilgiri Biosphere Reserve lead to a loss of 37% tree species in evergreen forests and 10% in sholas. Density loss was still much higher. It is interesting to note that in the disturbed moist deciduous and dry deciduous forests, there was an increase in plant species; mostly due to the invasion of weeds. In the case of birds, the Nilgiri Laughing Thrush, a shola specialist and the Nilgiri Pipit, a montane grassland specialist were the worst affected, both because of the disturbance and alteration of the Shola grassland into wattle plantation. Nesting trees and snags were favoured by wood collectors, affecting the breeding of birds in Mudumalai Wildlife Sanctuary.

Use of ethnobotanical knowledge of several species were recorded and for the first time the exploitation of medicinal plants from the various habitats of the Nilgiri Biosphere Reserve was documented.

The Environmental Impact Assessment of the controversial Puyamkutty Hydroelectric Project in Kerala brought out the unique features of the habitats, endemism and biodiversity of the area. The study unambiguously concluded that the area should be preserved in totality for posterity and that no further 'development' work should be promoted in the area. It was found that the mosaic of vegetation in the Puyamkutty area along with the rich flora and fauna of the adjacent areas including Eravikulam, Parambikulam and Indira Gandhi Wildlife Sanctuary should be declared as the Anamudi Biosphere Reserve.

The "Salim Ali Memorial Rolling Trophy" for the school which gets maximum marks in the nature competitions held for the children on the occasion of the 102<sup>nd</sup> Birth anniversary of late Dr Salim Ali went to Chinmaya Vidyalaya, Vadavalli, Coimbatore. Dr Abdul Kareem, Vice-Chancellor of the Tamil Nadu Agricultural University delivered the Salim Ali Memorial Lecture of the year emphasising the need for replacing chemical pesticides with bioproducts for the conservation of biodiversity.

### OBJECTIVES OF SACON

- ♦ to design and conduct research in ornithology covering all aspects of biodiversity and natural history; — Contradiction
- ♦ to develop and conduct regular courses in ornithology and natural history for M.Sc., M.Phil. and Ph.D. and also, short-term orientation courses in the above subjects;
- ♦ to create data bank on Indian Ornithology and Natural History; — Never done!
- ♦ to disseminate knowledge relating to ornithology and natural history for the benefit of the entire community; and — Never!
- ♦ to confer honorary awards and other distinctions to persons who have rendered outstanding services in the fields of ornithology and natural history. — Patronizing!

SACON's location in Coimbatore with the backdrop of Western Ghats, one of the 'hot spots' of biodiversity in the world, offers enviable opportunities to undertake long-term studies on various aspects of its varied avifauna, and on the biological principles and phenomena involved in the maintenance of the fragile systems. The trijunction of Kerala, Tamil Nadu and Karnataka in the Western Ghats, considered to be one of the best wildlife areas in the country having a larger number of Protected Areas, is only within a few hours of drive. SACON sets up field stations in various parts of the country according to the requirements of the research projects.



## ORGANIZATION

The SACON Society has 61 members comprising the President, all members of the Governing Council (15) including the Director, SACON, six nominees of BNHS, two faculty members nominated by the Governing Council every three years, 37 members nominated by the Governing Council. Director, SACON is the Member Secretary. Mr. B.G. Deshmukh IAS (Retd. Cabinet Secretary), continued to be the President during 1998-99 (Appendix I).

Administration of SACON is vested on a Governing Council comprising 15 members which include the Chairman (nominated by BNHS), seven ex-officio members, three nominees each of BNHS, and the Governing Council, and the Director, SACON, Member Secretary. (Box No.1). The Governing Council envisages a reconstitution with the Secretary to Government of India, MoEF as Ex-officio Chairman.

The Governing Council is advised by a Finance Committee and a Research Advisory Committee. It also has a Building Sub-committee to go through the nitty-gritty of the construction.

Research activities have been organized under six research divisions, namely Avian Ecology, Conservation Biology, Ecotoxicology, Environmental Impact Assessment, Terrestrial Ecology and Wetland Ecology. Scientific staff strength was 11 during the year, with four Principal Scientists at the grade of Rs.14300-400-18300 and seven Scientists in the grade of Rs.10000-325-15200.

Although the library had a Librarian and a Library Assistant, the Librarian has been transferred to Dehra Dun temporarily to help collect the unpublished data on biodiversity from the records of Forest Research Institute, as a part of the integrated project on the biodiversity of Anaikatty. The library, with its limited number of books and journals was effectively managed by the Library Assistant.

The administrative section comprises a Senior Administrative Officer, Finance Officer, Personal Assistant to Director, Administrative Assistant, Accounts Assistant, Office Assistant and a Stenographer.

## Organizational Chart



## SACON SOCIETY

The eighth Annual General Meeting of the Society was held on 7 December 1998 at Bombay Natural History Society, Mumbai. Mr B.G.Deshmukh IAS (Retd. Cabinet Secretary), continued to be the President.

### Governing Council (1998-99)

The Governing Council met thrice during the year (22 September, 7 December 1998 and 16 February 1999. Mr. Viswanath Anand, IAS, Secretary to Government of India, Ministry of Environment & Forests, continued to be the Chairman till August 1998. Thereafter Mr. Vinod Vaish, IAS, Special Secretary, Ministry of Environment & Forests became the Chairman.

**Box. No. 1. Members of the Governing Council**

**Chairman:**

Mr. Viswanathan Anand, IAS, Secretary to Govt. of India, Ministry of Environment & Forests (up to August 1998)

Mr. Vinod Vaish, IAS, Special Secretary to Govt. of India, Ministry of Environment & Forests (from September 1998)

**Joint Secretary & Financial Adviser, Ministry of Environment & Forests, Government of India**

Mr. P K Brahma (up to November 1998)

Mr. J.S. Maini, IAS (from December 1998)

**Secretary to Government of Tamil Nadu, Department of Environment & Forests**

Mr K S Sripathi, IAS,

**Vice-Chancellor, Bharathiar University**

Dr Balakrishna Ilango

**Director, Bombay Natural History Society**

Dr Azad Rahmani

**Director, Wildlife Institute of India**

Mr S K Mukherjee

**Chairman, Centre for Ecological Science, Indian Institute of Science, Bangalore**

Dr Raghavendra Gadagkar

**BNHS Nominees**

Mr J C Daniel, Dr. A.J.T. Johnsingh & Dr. D.K. Lahiri Choudhury

**Governing Council nominees**

Mr. K.P. Geethakrishnan, IAS (Retd.)

Mr. K.K. Nair IFS (Retd.)

Mr. S.P. Godrej

**Director, Sâlim Ali Centre for Ornithology and Natural History (Member Secretary)**

Dr V S Vijayan

**Research Advisory Committee (1998-99)**

The Governing Council reconstituted the Research Advisory Committee during the year (Box. 2). The RAC consists of 15 members. The RAC met on 24th March 1999 and reviewed the ongoing research projects and evaluated the new projects submitted by the faculty.

**Box. No. 2. Members of the Research Advisory Committee**

**Chairman:** - Dr. M.K. Ranjitsinh

Additional Inspector General of Forests, MoEF, Govt. of India -

Mr. S.C. Sharma, IFS

Director, ZSI - Dr. J.R.B. Alfred

Director, BSI - Dr. V.N. Singh

Mr. S.K. Mukherjee, Director, Wildlife Institute of India

Dr. T.N. Ananthakrishnan, Director (Retd.), ZSI

Dr. P.S. Ramakrishnan, Jawaharlal Nehru University

Dr. S. Ganeshiah, University of Agricultural Sciences, Bangalore

Dr. N.V. Joshi, Centre for Ecological Sciences, IISC, Bangalore

Dr. Priya Davidar, Pondicherry University

Dr. K.S.S. Nair, Director, Kerala Forest Research Institute

Mr. J.C. Daniel, Bombay Natural History Society

Dr. A.R. Rahmani, Bombay Natural History Society

Dr. R.K. Rai, Representative of MoEF

Dr. V.S. Vijayan, Member Secretary

## THRUST AREAS OF RESEARCH & MAJOR FINDINGS

### 1. Endangered species programme

It appears that the world loses about 17 million hectares of tropical forests every year and the extinction rate of species is 25,000 times the natural rate of the 9,723 bird species of the world around 1,100 are globally threatened. In India, of the 1,228 species around 100 are threatened. It is in this background that SACON launched an Endangered Species Programme focussing on the status, distribution and ecology of the species concerned in order to formulate long-term conservation programmes.

#### *a. Andaman Teal*

The Andaman Teal *Anas gibberifrons albogularis* is the only threatened and endemic species among the 49 Anatidae recorded in India, except the Pink-headed Duck which is believed to be almost extinct. Teal is restricted to the Andaman islands inhabiting freshwater streams, ponds, swamps and brackish water swamps, tidal creeks or estuaries.

The present population of Andaman Teal is estimated to be below 550 and roughly 25 pairs breed.

The Andaman Teal feed on invertebrates from soil and water and fingerlings of fish using mainly upending and billsubmerged methods. Animal matter was dominant in the pellets, contrary to the earlier reports that it is mainly a vegetarian. They spent 25 to 30% of daytime for feeding.

The peak period of breeding of Andaman Teal is August-September when maximum egg laying takes place. They nest on reeds (*Phragmites kirka*) in flooded wetlands. The nest was on open grass or reed mat with a slight depression in the centre lined by fine grass and supported by stems of reeds and aquatic ferns, *Acrostichum* sp. The reeds were 4-5 m tall and the nests were placed at an average height of 70 cm from the ground and 30 cm above the water. A clutch had 8 to 10 eggs; incubation period was 22-26 days and nesting success 78 to 93%.

Habitat destruction/ alteration and poaching were the two major threats posing the survival of this species. Some of our recommendations such as to include Photonala in Rutland Island in the Mahatma Gandhi Marine National park and John Lawrence and Henry Lawrence Islands in the recently declared Jhansi Rani Marine National Park were well received by the Forest Department and Andaman Administration. The Department on our request also showed keen interest for education programme focussing Andaman Teal.



### *b. Nicobar Megapode*

The family Megapodiidae are unique amongst birds as they incubate their eggs using external heat sources that include geothermally heated soils and mounds of forest litter. The megapodes are found mainly on islands, and are distributed in Indo-Australia and the Pacific. The Nicobar Megapode, endemic to the Nicobar Islands is the western most limit of the family.

The Nicobar Megapode build mounds of soil and vegetation litter within which microbial respiration generates the necessary heat for the eggs to incubate. We continued examining mounds of different types and dimensions to understand the correlation between mound type, dimension and heat source, and the degree of temperature fluctuation that the mound is subjected to, and their implications to the hatching success in the species. We also studied the social organization of the species, with particular reference to the use by multiple pairs of mounds and their territorial system.

The study on heat sources that create incubation conditions within mounds corroborated the data collected in previous years that microbial activity and size of the mound are the primary determinants of optimal incubation conditions. As 1998 was a relatively dry year, fewer number of eggs had been laid. As against 124 laid in 1997 in 23 mounds, only 35 eggs were laid in 1998 in 17 mounds. Incubation periods and temperatures were similar to that of the previous years. In 1998 four more birds were colour marked, bringing the total number of ringed birds to 28. Data collected on the social organisation of the species corroborated with the data collected in previous years.

### *c. Narcondam hornbill*

The Narcondam Hornbill, is endemic to the Narcondam island, in the Andaman and Nicobar group of islands, in the Bay of Bengal. Narcondam Island is an extinct volcano with an area of 6.82 km<sup>2</sup>, rising steeply to a central peak that is 706 m high. The Narcondam Hornbill was studied between end February 1998 and early June 1998. The primary objective of the study was to estimate the population of the species and identify the threats to it. Factors such as food and nesting sites that could regulate the population were also studied.

The Narcondam Hornbill is present throughout Narcondam Island excepting on the grassy slopes that dominate the south and southeast faces of the hill. In 1905, the population was estimated at 200 and in 1972 at 400 birds. Based on line transects and circular plots, the present study estimated the population to be between 295 and 320 birds. During the study period 17 nests were found, and the breeding population was estimated to be between 68 and 85 pairs.

Nesting begins in early February, and the female is sealed in a tree cavity. Holes on the trunk and those at the tip of branches were used equally. Seven species of trees were used for nesting and 57% of nests were on *Tetrameles insignis* and on an unidentified species. The majority of nests were found at the lower reaches of the hill, and only 12% were present above 200m. Two eggs are laid, and the female remains sealed within the nest till the chicks fledge. In all the nests monitored, both chicks fledged successfully. At fledging, both male and female chicks have the same plumage, which is similar to that of the adult male. Females develop the adult plumage only after a few months.

The male alone did all the provisioning at the nest. In addition to fig fruits, which form a large proportion of the diet of the Narcondam Hornbill, at least 33 types of fruit are exploited. Based on the seeds collected at the middens below nests, over 80% of the fruits provided (excluding ficus) at the nest belong to three species, namely *Caryota mitis*, *Sterculia rubiginosa*, and a number of Meliaceae. Apart from fruits, animal matter was also provided at the nest, the bulk of which was mantids while a spider, crab, and a lizard were also recorded.

The threats to the Narcondam Hornbill arise from the establishment of a police outpost on the island, manned by 17 personnel, in 1969. In 1976 the police introduced pairs of domestic goats, which by 1998 had grown to a population of 130-150 goats in the camp, and a population of over 250 feral goats, as a result of which there is no or very little natural regeneration in the island.

About two to three hectares of forest have been lost to the creation of the camp. At least 10 or 12 live standing trees are cut each year for fuel wood for the camp. Additionally over 500 poles were cut during a three-month period to make and repair fences that prevent goats from entering the vegetable plots.

The hunting of Narcondam Hornbill for meat exists. Between seven and 10 birds had been shot in a three month period and the probable annual loss would be about 25 to 40 birds. However, considering the large number of chicks produced each year, it is probable that the hunting pressure is not a very serious threat.

#### *d. Lesser florican*

Once the commonest and most widely distributed Indian bustard, the Lesser Florican *Sypheotides indica* appears to be seriously threatened with extinction, as a result of the extensive changes in land use practices, particularly over-grazing of its grassland habitat. The Lesser Florican breeds during the south-west monsoon (July-October), when they migrate into Western India, and disperse over an area of about 360,000 km<sup>2</sup>. Within this range, the species aggregates in three distinct areas: Saurashtra and Kutch, the Malwa Plateau, and Central and Eastern Rajasthan. Breeding primarily takes place in small,

isolated grass patches, rarely over 100 hectares, where the grass is allowed to grow long during the monsoon. Such grassland sites, known as *beed*, *vidi*, *rakhal* or *jod*, are owned both by individuals, collectively or singly, and by the Government. The grass *beed* has traditionally been protected from livestock grazing and the grass harvested, baled, stored and used during the summer or during droughts. Probably less than 2000 km<sup>2</sup> of grass *beed* is now left, and is seriously threatened by conversion into agriculture or degradation into grazing lands. The grass *beed* needs to be conserved if the Lesser Florican and other grassland species are to survive, and if fodder demands are to be met. Equally urgent, is a reduction in hunting pressures on the species.

Since 1994, SACON has been surveying western India to periodically assess the population of the Lesser Florican, and advocate its conservation. Advocacy of Lesser Florican conservation is effected by conducting workshops, the distribution of posters, and by direct interaction with people around important florican areas. A major annual activity is the development of the Florican Watch, a group of individuals who actively advocate the conservation of the Lesser Florican in their areas. In 1998, Saurashtra and Kutch were surveyed, and the florican watch was strengthened.

#### *e. Red data book for the birds of Asia*

The project for the preparation of the book was initiated as a part of the Global Action Plan of the BirdLife International (BLI) to save the rare birds from extinction. The precise objectives of the book are:

1. to identify and fully document all globally threatened species,
2. to identify the principal threats to the birds, and
3. to indicate and prioritize action for all threatened species in terms of key sites, habitats and appropriate management.

The entire project was planned to be executed through network of resource persons, collecting and compiling information. SACON is the nodal agency for the Indian section. The species, tentatively designated as globally threatened after a few discussion meetings, were assigned to authors for the preparation of the manuscripts. Informations on species from various museums from India and abroad, the latter collected through BLI were sent to the respective compilers. Many of the manuscripts were submitted during this year and were sent to BLI for final editing. The remaining species accounts are being prepared by BLI. The Book is planned to be ready by the end of 1999.

#### *f. Endangered species and protected areas*

We compiled data on the distribution of Critically endangered and Endangered species of amphibians, reptiles and mammals in order to examine whether our protected areas



adequately cover these species. For example, how many endangered species (Critically endangered and Endangered together) are represented in at least one protected area?

Only about 32% of the endangered amphibians and reptiles and 40% of the mammals are known to occur in at least one protected area. The remaining species are not definitely known to occur in our protected area network. This assessment is severely constrained by imprecise locality records of many species, poor accessibility to museum records and inventories of protected areas and, above all, lack of systematic surveys on the distribution of most animal taxa other than large and medium sized mammals and, perhaps, birds. However, even after a systematic assessment we might find that our protected area network is grossly inefficient in its coverage of the lower organisms. The conservation of large herbivores and predators (especially elephant and tiger) has been the major concern in the design of India's protected area network. This was also assumed to ensure the conservation of the lower organisms. However, the major centres of distribution of the large prey-predators, hardly coincide with the centres of distribution of the lower organisms. For example, within the Western Ghats the large prey-predators occur in very low densities in the tropical rain forest where species richness and endemism are the highest among the herpetofauna and small mammals. Thus a protected area network designed by and for large prey-predators are unlikely to adequately cover other taxa among which species richness, endemism and extinction risk are highest.

Another conservation goal has been to incorporate large areas at a few localities into the protected area network. The assumption has been that, like the large mammals, most of the other organisms of a region (*e.g.* Western Ghats) would be represented in a few large protected areas. It is now becoming clear that this is far from true. Our studies indicate that the very high species richness of amphibians and reptiles in the Western Ghats is due to a high turn over of species from one locality to another. Thus, a few large protected areas would not include all the species of these taxa. It is very important in the present context that we systematically reassess our protected area network in order to ensure that all our species are adequately covered. In short, we need to urgently assess whether our protected areas cover taxa, which are at greater extinction risk, such as amphibians and reptiles. Conventional approaches such as using flagship or umbrella species (*e.g.* elephant and tiger) or a few large protected areas are not the answers to the problem of protecting a large majority of our threatened species.

## **2. Environmental contamination and biodiversity**

Conservation initiatives in India often do not weigh the deleterious effects of environmental contaminants on the survival of species and ecosystem. Habitat destruction has often been shown as the major threat to many of the species. Environmental contaminants unless reach a lethal level, no serious attention is paid. Fertilizers and pesticides from agricultural activities and industrial operations are

getting released into the environment and causing harm insidiously. However, the resultant ecological imbalance remains undocumented. Monitoring of environmental residue levels of problem chemicals is very essential to generate a database so as to give out early warning signals.

SACON attempts to quantify the environmental residue levels of contaminants especially pesticides and heavy metals in various biological and non-biological components in the Nilgiri district which is part of the Nilgiri Biosphere Reserve. We have also initiated an all India coordinated project to monitor the environmental contaminants in birds wherein all the field biologists, forest officials, if they came across any dead or moribund birds, could send in the specimens to SACON. Samples will be analysed for certain environmental contaminants and a database generated.

#### *a. Pesticide contamination in the nilgiris district*

An intensive survey carried out in the Nilgiris district reveals that, approximately 600 metric tonnes of pesticides in the form of granules and powder and 28,000 liters in the form of liquids are being used every year. The district is prone to contamination, as the cropping pattern and the type of pesticides used are quite diverse. The concentration of these contaminants in various tropic levels, especially on birds is being assessed.

Seasonally, samples of water, sediment and fishes from reservoirs (Avalanche, Emerald, Kamaraj Sagar, Pykara, Upper Bhavani and Moyar-Maravakandy) from Ooty lake and rivers (Coonoor and Moyar) were analysed. Six species of birds trapped from various parts of Nilgiris were also processed and residues of three isomers of BHC (alpha BHC, gamma BHC and beta BHC) and four metabolites of DDT (p,p' DDE, p,p' DDD, p,p' DDT and o,p' DDT) and two metabolites of endosulfan (alfa and beta) were analysed using Gas Chromatograph.

#### i. Pesticide contamination in water

Alpha, gamma and delta isomers of BHC, four metabolites of DDT and traces of alfa endosulfan were detected in the waters of Nilgiri district. The contamination level differed among the sampling locations and seasons. Of all the locations, the data collected till date indicate that the waters of Pykara reservoir to have the maximum pesticide residues and Upper Bhavani the minimum. However, the levels are not too high to sound alarm call.

#### ii. Pesticide contamination in sediments

Three isomers of BHC (alpha, gama and beta), two metabolites each of DDT and endosulfan were found in the sediments collected from various sampling locations in the district. Unlike water, seasonal variation in concentration of pesticides was less



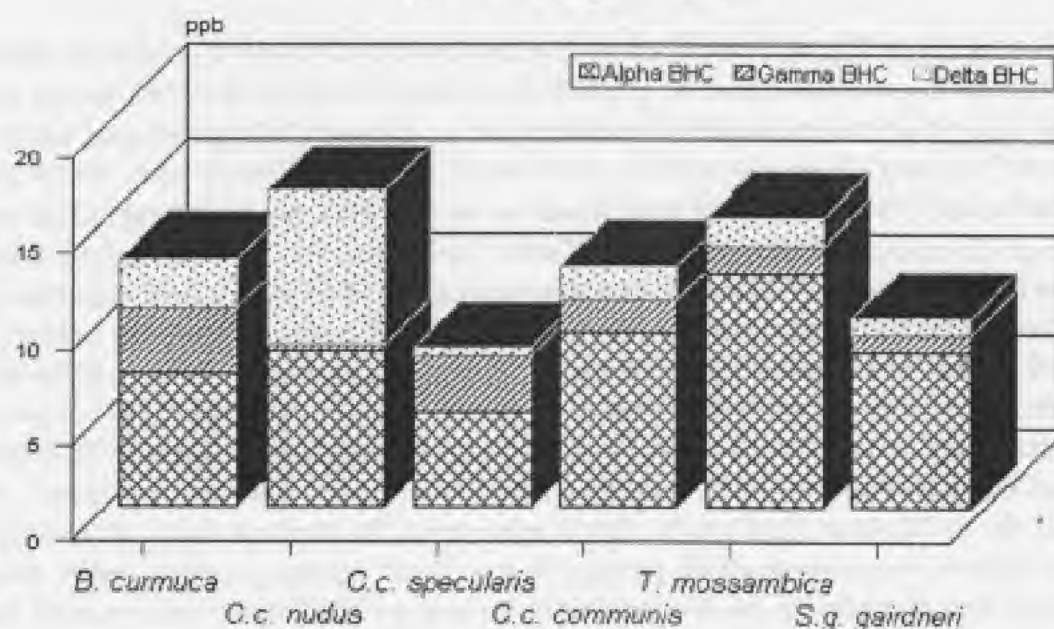
among the locations. Sediments of Kundah measured the maximum concentration of gamma BHC (0.07 ppb) and Moyar - Maravakandy the minimum. Highest concentration of (1.62 ppb) alpha BHC was detected in the sediments of Pykara and lowest in the sediments of Moyar river (0.62).

Of all the study sites only the sediments of Emerald reservoir had 0.28 ppb of beta endosulfan. In the case of DDT, the trend of residue level remained the same as that of the earlier seasons, however the levels varied marginally.

### iii. Pesticide contamination in fishes

Residue data on six species of fishes, namely *Cyprinus carpio communis* (Scale Carp), *C. c. nudus* (Leather Carp), *C. c. specularis* (Mirror Carp), *Salmo gairdneri gairdneri* (Rainbow Trout), *Tilapia mossambica* (Cichlid) and *Barbus curmuca* (Curmuca Barb) have been compiled. Although all the species showed minor variations in their contamination level from that of the previous year, the general trend remained the same. The Leather Carp had the highest load of BHC followed by *Tilapia musambica* (Figure 1) Residues of the metabolites of DDT were detected in all the species of fishes analysed. P,p' DDD ranged from 2.78 to 0.075 ppb while p,p' DDT from 2.98 to 0.052 ppb. The later was detected in the fishes of all the reservoirs except Upper Bhavani, similar to last year. Traces of endosulfan were also detected in the fishes of Kamaraj Sagar. Fishes of Moyar had trace levels of endosulfan during the last year, however, this year it was below detectable level.

Figure 1. BHC residues among a few species of fishes in Nilgiri district



#### iv. Pesticide contamination in birds

Large Cormorant, Little Egret, Cattle Egret, Pond Heron, Common Myna and Jungle Babbler from various parts of Nilgiris district were analysed for pesticide residues. Preliminary analyses show varying levels of contamination. Concentration varied among brain, heart, liver, kidney and muscle. Albeit the levels are not alarming, they have to be treated with concern as even low level of exposure if continued for a long period of time, may pose problem. Further sample analyses are in progress.

#### *b. Heavy metal contamination in Nilgiri district*

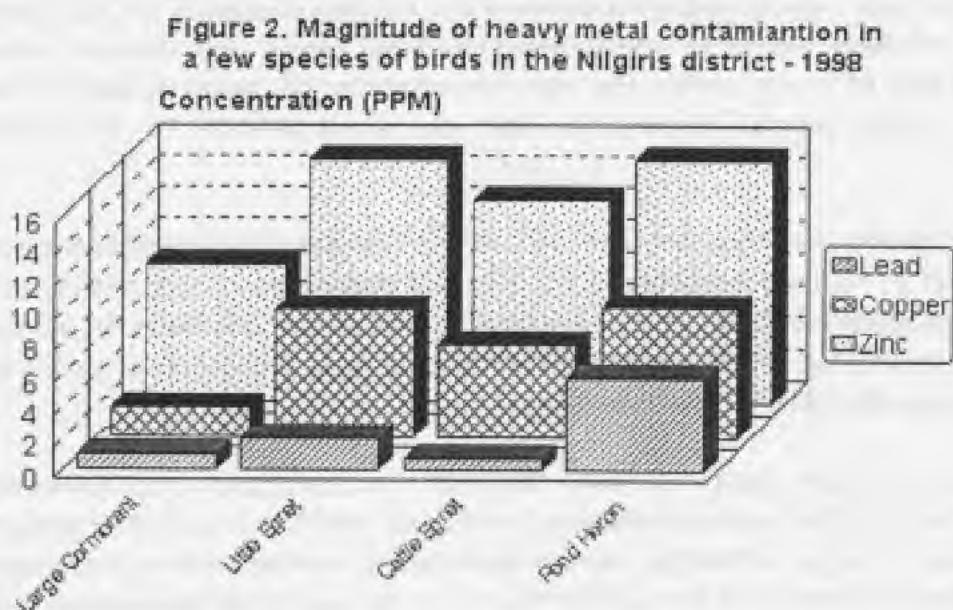
Metals, unlike pesticides are natural in origin and their presence in trace is needed for normal functioning of any living organism. However, when the levels get elevated because of human activities such as industrial operations and agricultural activities, they pose problem.

Birds could be valuable indicators of ecosystem contamination, as they occupy a wide range of trophic levels in different food chains and thereby get exposed to different concentrations of heavy metals. Similarly, fishes also serve as valuable indicators, as they occupy higher trophic level in an aquatic system. Further, their relative abundance, high nutritive value and capacity to accumulate various metals in body organs help us understand the problem in a better way. Large Cormorant, Little Egret, Cattle Egret, Pond Heron, Common Myna and Jungle Babbler and various species of fishes have been studied in the Nilgiris district.

#### i. Heavy metal contamination in birds

Body tissues of Little Egret, Pond Heron, Cattle Egret and Large Cormorant showed high variation in the concentration of copper (Cu), lead (Pb) and zinc (Zn). In the Large Cormorant liver had the maximum concentration of copper (3.54 ppm) and brain the minimum (0.72 ppm). Brain recorded a maximum concentration of zinc (11.39 ppm) followed by heart (9.5 ppm). Lead was found to be the maximum in heart (2.45 ppm) and minimum in muscle (0.18 ppm). In the Cattle Egret *Bubulcus ibis* the highest level of copper was found in brain (7.32 ppm) and lowest in heart (4.46 ppm). Zinc was found to be the highest in heart (23.41 ppm) and lowest in liver (2.1 ppm). In the case of lead, the liver recorded the maximum concentration (3.98 ppm) followed by kidney (1.16 ppm) and the minimum concentration in heart (0.09 ppm). In the Little Egret *Egretta garzetta* copper accumulation was more in brain (11.86 ppm) and less in muscle (5.3 ppm). Kidney had the maximum concentration of zinc (27.65 ppm) followed by brain while muscle had the minimum (8.18 ppm). Brain measured the highest level of lead (4.612 ppm) and kidney the lowest (0.45 ppm). In the Pond Heron *Ardeola grayii* copper concentration was recorded to be the maximum in kidney (9.77 ppm) followed by brain (8.47 ppm) and minimum in muscle (4.53 ppm). Brain tissues had the highest

concentration of zinc (27.57 ppm). Liver recorded the lowest level of lead (4.73 ppm) while kidney the highest (6.83 ppm). The magnitude of contamination differed among the four species of birds (Figure 2).



The accumulation pattern among the tissues also showed perceivable difference. Brain tissue accumulated the maximum in all the species except the Cormorant, which had the highest accumulation in heart. Muscle tissues had the least accumulation in the Cormorant and Little Egret while heart and liver tissue had the minimum in the Pond Heron and Cattle Egret respectively.

The observed differences among the four species of birds studied could be due to factors such as the level of contamination in the food, feeding zone and various physiological and geological factors. Although the present level of contamination is not alarming, it is of concern as even low level of exposure if continuous, can pose serious problems in long run.

In order to evaluate any instance of metal poisoning, "normal" levels of them in the concerned species must be known and the abnormal levels that tend to produce either harm or no apparent harmful effects must be recognized. But at present no such information are available on any of the four species studied or for that matter any of the avifauna of the country. Hence information on naturally occurring level of problem metals, not only in Nilgiris district but for the entire country is indispensable for all species of birds.

The All India Coordinated Project on Environmental Contaminants in Avifauna, which SACON has launched recently will provide such base-line data also.



### *c. Heavy metal contamination in Coimbatore city*

1. *Chemical fractionation of heavy metals in sediments of select wetlands in Coimbatore city* documents the heavy metal pollution status of the various wetlands in Coimbatore. The fractionation of these elements into various chemical forms was explored and it was found that in case of heavy metals, the total concentration of metal in water or sediment is of lesser environmental importance than the concentration of the bio-available fractions.

2. *Ambient air quality and Noise levels in and around Coimbatore city* reports the air quality and noise level in various locations of the city. All parameters of air quality of the city were within permissible limit. The noise level exceeded the ISI limits, in all the zones, except a few residential zones. Strict legislative measures, formation of green belts and public awareness shall bring down the level.

3. *Assessment of water quality of select wetlands in Coimbatore City* documents that Coimbatore city is gifted with a number of wetlands, which is a source of ground water. There are about 11 major wetlands, most of them facing various problems of degradation. The present study documents the state of the wetlands and identifies various reasons for the degradation of their environmental quality.

### **3. Man and biodiversity**

Man has been living in harmony with nature since time immemorial. This harmony has been disrupted since human population started increasing and the demand on biological resources became many-fold. Gradually the relationship between man and nature became destructive proposition leading to habitat loss (estimated at 0.6% per year in the tropics) and fragmentation, over-harvesting of wild populations, chemical pollution, introduced species and, lately, climatic changes, all posing threats to the biodiversity and thus, to the very survival of man. It is in this context that the Convention of Biological Diversity made it mandatory on all countries to make a systematic assessment of the impacts of these threats on ecosystems and species in order to prioritise them for conservation action. It has thus become a major area of research interest in SACON.

#### *a. Fragmentation of forest and biodiversity*

As natural ecosystems all over the world fragment and shrink, it is becoming clear that the survival of most species depends on our ability to manage fragmented ecosystems. This is particularly true of tropical forests, the storehouse of biodiversity. For example, in the Western Ghats, a biodiversity hotspot, the loss of forests was as much as 40% between 1920 and 1990, with a more than four-fold increase in the number of forest patches. Large and contiguous populations of many species have now been reduced to

small isolated populations which are highly extinction prone. More over, habitat degradation and changes in environmental conditions in and around the fragments cause further loss of species. The other biodiversity hotspot in India, the Eastern Himalaya, is also similarly threatened.

Studies on the ecology, behaviour, demography of species and management of fragmented ecosystems of the Western Ghats are one of the major thrust areas of research. Salient features of the observations are summarised below:

#### i. Loss of species from forest fragments

The nature of changes in species assemblages, especially species loss, owing to fragmentation of rain forest in the Western Ghats have been examined for the last six years. Small mammals (arboreal mammals, terrestrial rodents and shrews), small carnivores, amphibians and reptiles, which show high species richness and endemism were studied

In the Anamalai Hills, the endemic small mammals are highly prone to extinction from rain forest fragments. A typical example is the Malabar Spiny Dormouse (*Platacanthomys lasiurus*), an endemic and taxonomically unique species, being the only member of the Family Masegadinidae in India. This species shows very high extinction rate from forest fragments, probably due to the loss of lianas and buttress trees which the species is strongly associated with in contiguous forests. Other examples of extinction from forest fragments include two other endemics, the lion-tailed macaque (*Macaca silenus*) and Nilgiri langur (*Trachypithecus johnii*). In contrast, some resident non-endemic species increase in abundance; for example Giant Squirrel (*Ratufa indica*) and Large Brown Flying Squirrel (*Petaurista petaurista*). There is also an invasion of several species of commensal rodents into the forest fragments, for example *Mus musculus*, *M. booduga*, and *Golluna ellioti*. The loss and gain of species as well as changes in their abundance seem to be only partly related to fragment area, the other important factors being habitat features such as tree density, canopy height, and spatial heterogeneity.

#### ii. Changes in ecology, behaviour and demography

The lion-tailed macaque in the forest fragments shows a substantial reduction in the intake of invertebrates, a major source of protein for the species. Similarly, a reduction in the plant species in the diet of the Nilgiri langur might be a major factor adversely affecting the species. Small carnivore community in forest fragments was studied along with an attempt to study the ecology of 13 species of carnivores using scat analysis and radio telemetry. Frugivorous civets are dominant among small carnivores in rain forests. It is expected that this community would drastically change in the forest fragments due to the decline in fruit abundance and increase in terrestrial rodents and shrews. In Kalakkad-Mundanthurai Tiger Reserve reptiles and amphibians show relatively low



alpha diversity, despite high species richness in the Western Ghats. Species assemblages in amphibians change from one drainage to another, as well as across hill ranges, while that of reptiles change with altitude. Both these patterns of distribution have implications on the occurrence of species in forest fragments.

#### *b. Wildlife corridors*

Many forest fragments in the Western Ghats are interconnected through narrow habitat corridors, the loss of which disrupt seasonal migration of large herbivores such as elephants and gaur. Such loss would also block genetic exchange of many species. A systematic assessment of the importance of habitat corridors, their vegetation status and animal use of seven corridors in the Nilgiri Biosphere Reserve has just been completed.

The major findings were a) most of the corridors were dominated by relatively few species of plants and interestingly all the corridors had high proportions of elephant food trees b) most of the invading plant species were of no food value to the herbivores c) many of the corridors were used greatly during the dry season d) wood collection, grazing and collection of non-timber forest produces were the major human activities in the corridors which adversely affected the food resources of wild herbivores. The study also identified three major migratory routes of elephants in the Nilgiri Biosphere Reserve.

#### *c. People's participation in biodiversity conservation*

SACON has proved successfully, the positive impacts of people's participation in the conservation of biodiversity. Such participation is more relevant where the habitat is threatened because of the over exploitation of resources by people living around it. The study conducted in Sujalkuttai-Bannari corridor connecting the Western Ghats to the Eastern Ghats showed that if alternate livelihood are provided, the people resist their temptations to look up to the forest for meeting their resource requirements. We did not impose anything on the villagers. Instead, asked their choice for livelihood such as poultry, dairy farming, piggery and sheep. Since they chose dairy farming, we organized training programme for them, arranged high yielding cow through loans from banks, assisted in constructing up cattle shed, provided land for fodder raising and met such other requirements for sustaining dairy farming. Cooperation and collaboration of the various departments of State Government such as Animal Husbandry, Forest and Wildlife, District Rural Development Authority, Agriculture Research Station, Rural Extension Training Centre, Public Works and Department were ensured. At the end of the project, after two years, the people were not interested in the forest for firewood either for their own use or for commercial purpose.

Taste of success allure us to take up more such projects.

#### *d. Human interference on the plant and bird communities in the Nilgiri Biosphere Reserve*

The Nilgiri Biosphere Reserve has a long history of human interference through various "development" projects which have brought in substantial changes in the ecological scenario of the area. However, no concrete attempt has been made to bring out such changes, especially on the plant and bird communities. Therefore, a project was undertaken for three years to: (1) study the structure and function of bird and vegetation communities in different habitats and to assess the impact of disturbance on them in the Nilgiri Biosphere Reserve, (2) bring out the relation between bird-species diversity and habitat diversity, and (3) determine the impact of disturbance on endemic and rare species in different habitats of the Nilgiri Biosphere Reserve and suggest conservation strategies

##### i. Disturbances

The major disturbances to the existing forests and other habitats are lopping or cutting of trees, cattle grazing and conversion of grassland for wattle plantation. Fire also contributed to the disturbance which was more in the montane grassland and wattle plantation and dry deciduous forest.

##### ii. Vegetation

About 3200 species of plants were recorded earlier from NBR, out of which 750 plant species belonging to 97 families were encountered during this study

*Plant community:* Tree diversity was the maximum (3.43) in the undisturbed evergreen forests and minimum (0.20) in the wattle plantation. Shola forests had the maximum tree density.

Evergreen forests, in the disturbed sites recorded a loss of 36.7% tree species and 35% of density, while Coffee plantation had a decrease of 63% and 77% respectively when compared to the undisturbed sites. Disturbed shola forests had a decrease in tree species and individuals, 10 and 31% respectively. On the contrary, in the moist deciduous and dry deciduous forests, disturbed sites recorded relatively more species and in the thorn forest there was no difference. Forest plantations recorded lower species richness, density and diversity of trees and shrubs. Exotic weeds have spread out extensively, particularly in the disturbed sites and plantations and hence, the increase of species in disturbed moist and dry deciduous forests.

*Regeneration:* Species richness and density of recruitment class of plants were low in the disturbed sites and still lower or nil in the forest plantations

*Endemics:* 46 species of endemics (24 trees, 9 shrubs and 13 herbs) were observed during the sampling. Shola forest and grassland had the maximum (57%) followed by evergreen forests (41%). Population density of endemic trees and shrubs was low in the disturbed sites and much lower in the forest plantations.

### iii. Avifauna

Of the 413 species (including sub species) recorded, 81% are land birds and 19% aquatic, 74% are resident, 21% are migrants and the rest (5%) of unknown status. Abundance status is not clearly known for about 22% while 7% are rare. According to the IUCN criteria three are threatened, 28 near-threatened, and the rest safe. The list is being revised. All the 17 species of birds endemic to the Western Ghats are recorded, of which only the Nilgiri Laughing Thrush is endemic to NBR.

*Bird communities:* With moderate disturbance, the number of species increased while the number of birds decreased, especially the habitat specialists and endemics. Plantations had very few species and their population was also very low. Disturbances such as lopping of trees and cattle grazing have resulted in changes in the composition of plants and birds in a corresponding manner.

*Bird species diversity and foliage height diversity:* Foliage diversity in different strata of the forests had significant difference between the two forest types and it had significant correlation with bird diversity in the scrub ( $r_s=0.874$ ) and in the dry deciduous forest ( $r_s=0.814$ ). However, general bird population of the area did not show such correlation, indicating the importance of the functional relationship between foliage structure and foraging of birds.

*Foraging pattern of birds:* Foraging patterns are largely separated by the foraging height, location and method. There are two distinct foraging environments (forest floor and plant surface) in the thorn forest and four (forest floor, air, shrub, and trees) in dry deciduous forest. Twenty species showed changes in foraging heights between habitats, whereas only seven had changes in the foraging behaviour.

*Breeding birds and the impact of disturbance:* A total of 302 nests of 30 species of birds were observed during 1995 and 1996; 200 nests of 22 species in the thorn forest and 102 nests of 20 species in the dry deciduous forest. Hole-nests were abundant (35%) in the dry deciduous forest and dome-nests (30%) in the thorn forest. 26 plant species were used for nesting; the diversity of nests was greater on *Anogeissus latifolia* (2.0) followed by snags (1.6). Tree species such as *Anogeissus latifolia*, *Acacia chundra*, *Erythroxylum monogynum* and snags were collected by the local people in large quantities which were the preferred species of birds for nesting.



The number of nests had direct positive correlation with the availability of snags. Density of snags was lower in the scrub than in the dry deciduous forest and so even the number of nests. The number of nests decreased with proximity to human settlements. Species composition also changed, habitat specialists prefer more of undisturbed areas in the forest. In the scrub 19 nests of 10 species were in the undisturbed whereas 12 nests of 6 species were in the disturbed. In the dry deciduous the undisturbed had 9 nests of 4 species and disturbed 6 nests of 4 species. Fire destroyed 19 nests of 6 species in a 5 ha plot in the dry deciduous forest in 1995.

Plant species preference and nest-site characteristics of the major species, especially, habitat specialists such as the Paradise Flycatcher, White-browed Fantail Flycatcher, Crested Hawk-Eagle were identified. Most of these, except the Bay-backed shrike, were sensitive to disturbance.

The endemic birds such as the Nilgiri Laughing Thrush and Nilgiri Pipit are habitat specialists, the former of the shola forests and the latter of grasslands. The Nilgiri Laughing Thrush is globally threatened. Its population declined by 37% with disturbance and 79% by altering the habitat into wattle plantation; breeding population was 7 pairs/ 4 ha in the former and 1 pair/ 20 ha in the latter.

Population of the Nilgiri Pipit is reduced by about 60% when the grassland is converted into wattle plantation.

### *c. Ethnoecology*

The term ethnoecology is increasingly used to encompass all studies which describes local people's interaction with the natural environment. Ethnobotany is that part of ethnoecology which concerns plants. Systematic research into local ecological knowledge allows us to address theoretical questions about the relationship between humans and their environment and contribute to rural development and biodiversity conservation. Cataloguing information on the local use of plants would have multifaceted value. For example, the traditional use of a plant may be an indication of the presence of chemicals valuable to medical progress. It is known that about 75% of the 121 biologically active plant-derived compounds presently in use world wide, have been discovered through ethno-medical approach. Over 95% of the medicinal plants used by the pharmaceutical industries are collected from wild. As a result of continued exploitation and habitat destruction several medicinal plant species have become rare in the wild. The tribal knowledge on wild harvested species would be a valuable information for the conservationists and forest managers for the cultivation and conservation of medicinal plants.

Therefore, the need for documentation of traditional ecological knowledge, studying the status and ecology of medicinal plants under pressure from humans and chemical

screening of potential medicinal species was found important. Hence, a comprehensive study involving all the above three aspects was launched in Western Ghats (Nilgiri Biosphere Reserve) which is identified as one of the biodiversity hot spots.

The study covered Wynad Wildlife Sanctuary, Attappady Valley and Coimbatore Forest Division. For documenting the tribal knowledge, we interacted with the tribals in those areas, namely Irulas, Kurumbas, Kattunaikans and Mudugas.

One hundred and eighty eight ethnomedicinal plants belonging to 72 families were recorded from four tribal groups. It includes 15 new ethnomedicinal plants and 56 new uses. Euphorbiaceae (14 spp.) followed by Verbenaceae and Acanthaceae were the dominant families contributed the ethnomedicinal plants.

Herbs contributed to the maximum (34.9%) of ethnomedicinal plants. Among the various parts used, roots/ rhizomes contributed the maximum (32.1%) followed by leaves (30.8%). *Glycosmis pentaphylla*, *Helicteres isora* and *Cyclea peltata* were the first three species among the most commonly used medicinal plants. Maximum number of species ( $n=29$ ) was used to treat digestive disorders.

The commercially exploited plants were 85 species, 27 were identified during the present study and 58 reported by earlier workers. It also includes three endemics. Majority of them were contributed by trees (37%). Among the 85 species, 42% were exploited for underground parts (roots/ rhizomes/tubers) and 10% for reproductive parts (seeds, fruits).

Destructive harvesting, ie. the collection of whole plants, roots, rhizomes and ring barking of trees, was noticed in several species. Dry forests are one of the most threatened habitats in NBR; 34% (29/85) of the commercially exploited species occur in dry deciduous and scrub forests.

Species richness of ethnomedicinal plants was highest (69) in the moist deciduous forests followed by riparian forests (62). A comparison between slightly disturbed and undisturbed habitat showed lower values of species richness, diversity and overall density of medicinal trees and shrubs in the disturbed dry deciduous forests. Total density of seedlings and saplings was also found lower in the disturbed site. Similar trend was observed for riparian forests also. In the disturbed riverine forest 12 trees and 15 shrubs were recorded whereas in the undisturbed riverine forest site, 23 trees and 21 shrubs were recorded. Teak plantations were also rich in medicinal plant wealth; 39 medicinal plant species including 3 endemics and one threatened species were recorded here. Of the 35 commercially exploited species recorded in the quadrats, eight had a narrow distribution, occurring only in one habitat. Four species showed poor regeneration, which might be due to over-exploitation.



Of the five medicinal plant species screened, steroids and alkaloids were found in all the five species. Phenolic compounds were observed in four species and all the five species gave negative results for triterpenoids.

#### *f. Habitat monitoring*

##### Bandipur National Park, Karnataka

Monitoring changes in species populations and their habitats is a vital component in understanding and delineating approaches for long-term management. The Bandipur National Park, a deciduous biome of great importance in the Nilgiri Biosphere Reserve has been chosen for monitoring the habitats of two megaherbivores ie. Asian Elephant and Gaur.

Many of the ecological studies conducted during the last two decades have provided a good understanding on the structure and functions of deciduous ecosystems in Peninsular India. There have been almost no follow up or monitoring studies in habitats/ecosystems susceptible to changes from human induced and natural causes. In particular, aspects of management relevance include changes in vegetal cover, weeds, human pressure, cattle grazing, fire and impact of management practices on habitat.

Using thematic vegetation maps from Forest Survey of India and observations from field visits, vegetation boundaries were demarcated on 1:50,000 maps. In addition, 1:50,000 scale geocoded false colour composites of IRS-IB for February 1994 were interpreted for an assessment of summer habitat. Data on human population in villages surrounding the National Park were collected.

Digital analyses of Landsat Thematic map data covering bands 2, 3 and 5 were undertaken on IBM RS 6000 workstation using EASI/PACE software. Based on the request from the park management, to assess the incidence and extent of fire occurrence a time series satellite data has been procured for the years 1990-1995. The analyses are under way.

For change analysis, two time Landsat TM digital data for the period 1989-1994 were obtained from NRSA. Using the 1:50,000 geocoded false colour composites and ground information, habitats were -stratified for rapid quantification of vegetation parameters and large mammal abundance.

Habitat supply models (HSM) for various seasons for elephant and gaur were produced using digitally classified vegetation theme and known habitat requirements of the above herbivores.

#### 4. Environmental impact assessment

SACON undertakes Environmental Impact Assessment to protect the environment without hampering development. Our major objectives are: a) to take up EIAs and prepare Environmental Impact Statement (EIS) and Environmental Management Plan (EMP) for development projects such as industries, industrial estates, refineries, pipelines, mines, power plants, roads, hydel and hydroelectric projects; b) to develop guidelines for future projects and to undertake posteriori analysis of existing projects and post-EIA audits; c) to provide advice and facilities to other educational and research organisation in EIA related matters; d) to maintain the centre as a referral laboratory in the matter of Environmental issues; e) to participate in regular monitoring of environment in environmentally sensitive areas and to suggest means to control environmental problems as and when required and f) to take up long-term research projects on Environmental Assessment related fields to develop guidelines for future. During 1998-99 we undertook five EIA projects.

##### *a. Ecological impact of the proposed Puyankutty hydroelectric project in Kerala*

The Kerala State Electricity Board requested SACON to undertake a study on the ecological impact of the proposed hydro-electric project in Puyankutty. The scope of the study as per the terms of reference were: the following: i) threatened plants and animals of the area and their endemism; is endemism with reference to Western Ghats, Kerala or to the specific forest facing submergence under the project?, ii) population studies of economic plants of the area and adequacy of mitigatory measures, and iii) elephant population in the forest to be affected; their corridors, and the likely impact on them.

Standard methods were used to survey the floral and faunal components. Field surveys were undertaken in 314 km<sup>2</sup> area from January 1998 to January 1999 to gather primary data.

The Puyankutty catchment is a mosaic of various types of vegetation such as, evergreen, semi-evergreen, moist-deciduous, riverain, reed-brakes, grasslands and plantations. Human habitations are also present in the catchment. A total of 526 plant species was recorded from the area which include a number of economically important plants and many plants useful in Indian medical systems. The vertebrate fauna consists of 289 species (fish - 34, amphibians - 22, reptiles - 43, birds - 168, mammals - 22). Mammalian fauna, especially large mammals, is poor in terms of their population. About 25 elephants were estimated to be present in Puyankutty. The Puyankutty forest is rich for species endemic to the Western Ghats (61 plants, 2 species of fish, 11 amphibians, 10 reptiles, 11 birds and 2 mammals). However, no species of animals or plants was exclusively endemic to the Puyankutty forests. The study of the biological values of the area conclusively shows that the Puyankutty area has to be preserved at all cost for posterity.

Protection of the entire forest currently available in Puyankutty is vital for the long-term conservation of the biodiversity of the area.

#### *b. Rapid ecological impact assessment of Saneer's Alloys Pvt. Ltd*

The Saneer's Alloys (Private) Limited (SAL) manufactures castings of various grades of carbon and stainless steel alloys using medium frequency electric induction furnace. The plant has incorporated important pollution control measures in its design. The moulds for casting are made of silica sand, bonded with CO<sub>2</sub> cured Sodium silicate. The major raw materials for SAL are scraps of stainless and high carbon steel, turnings and borings from other industries and, used and damaged metal items suitable for recycling. Large quantity of high silica sand (sea sand), refractory materials such as fireclay and sodium silicate is also required.

The area falling within ten kilometer radial distance from the project site, assumed as the impact zone of this project was studied intensively. It is mostly agricultural land, human habitations, fallow lands and built-up area. The dominant vegetation is plantations and agricultural crops. No wildlife sanctuary is situated in the environs of SAL. No perennial water body is also present in the immediate vicinity. The faunal species found in the study area are highly adaptable and have wide distribution elsewhere in India. The SAL production unit is not expected to release gaseous emissions in a level which may affect the fauna, flora and people inhabiting the vicinity. The project is not expected to release any liquid effluents. The major waste generated during operation will be solid wastes, mainly used sand moulds. Approximately 3 tonnes of solid waste will be generated everyday. Economically viable method, available for the re-use of the sand from Na<sub>2</sub>SiO<sub>3</sub> - CO<sub>2</sub> bonded moulds and cores in founding activities, may be adopted so that the major portion of the sand may be re-used. The use of wasted moulds for land filling is not expected to pose any serious environmental problems. The major pollutants emanating from the operation are metal fumes and NO<sub>x</sub>. SO<sub>x</sub> is expected from the generator. Fume hoods for the induction furnaces, chimneys for the generator and air-shot blasting machine are installed. However, installation of a better chimney for the generator, a blower for the exhaust from the induction furnace and metal fume capture mechanism are suggested. The study concludes that in a long-term perspective, the project does not pose any notable environmental problems. However, it is suggested i) to identify and document the solid waste disposal site and ii) chemical monitoring of the solid waste for leachables. Development of a green belt is also suggested to enhance the quality of environment.

#### *c. Rapid ecological impact assessment of Ultimate Alloys (Pvt.) Limited*

Saneer's Alloys (Pvt.) Ltd and the Ultimate Alloys (Pvt.) Ltd (UAL) were similar type of industrial units involved in similar activity. They have similar infrastructural facilities

and operational techniques. Therefore, the methodology employed for the study, the findings, conclusions and recommendations were also similar.

#### *d. Impact Assessment of Vijayawada - Secunderabad Pipeline*

The ecological impact of the proposed 223 km long pipeline from Vijayawada to Secunderabad, traversing three districts of Andhra Pradesh, to transport petroleum products, namely petrol, diesel, kerosene, naphtha and aviation fuel was undertaken in 1988-99. The entire route of the pipeline was examined following sample survey method. The pipeline passes mostly through private owned cultivable lands, fallow and waste lands. 114 species of plants comprising four species of climbers, 54 herbs, 28 shrubs and 28 trees were recorded along the path of the pipeline and its environs. No notified sanctuary or national park occurs along the pipeline route and no diversion of forest land is also proposed in the project. However, about 4400 trees, mostly planted species, will be felled during the creation of RoW. Since, no diversion of forest land is proposed in the project, no compensatory afforestation is mandatory. Nonetheless compensatory tree planting is suggested with local species.

Five species of mammals, 75 of birds, 21 species of reptiles and nine species of amphibians are expected in the environs of the pipeline, of which only six are listed in schedule I & II of the Wildlife Protection Act. However, most of these animals are highly mobile and are not very prone to short-term disturbances that are likely during the construction of the pipeline. An attempt to grade the ecological sensitivity / significance of the pipeline route based on the occurrence of animals belonging to schedule I & II, floral and faunal endemism, and legal status of the area suggests that the route passes through areas of low ecological sensitivity. The major impact of the pipeline project is during the construction. The underground pipeline during the operation phase practically does not pose any threat to the local ecological makeup, except in case of accidents such as leakage which have low probability.

#### *e. Impact of effluents of dyeing industries*

The river Noyyal in Tirupur receives about 75000 M<sup>3</sup> of effluents from more than 750 industrial units engaged in dyeing and bleaching textiles. As a result a large check dam constructed downstream at Orathupalyam, 20 km from Tirupur for irrigation purpose has become futile. A study of the water quality of the river shows high level of pollution in the river. The water was deep in colour and had a foul odour, the former due to unspent dyes from the dyeing process and the latter because of the various chemicals used in bleaching. The dyes used in Tirupur are synthetic. The azo-dyes which were in wide use were banned recently owing to their carcinogenicity. COD was in the range of 160-435 mg / L because of many organic synthetic chemicals. Hardness up to 1700 mg / L and chloride up to 4500 mg / L were due to the salts used in large quantities in the process. Water from the check dam at Orathupalyam had high chloride content (4500 mg



/ L) and total solids (8000 mg /L). The farmers in the area do not use this water for irrigation, as it causes low germination of seeds. Farther, groundwater is also contaminated severely.

## ONGOING PROJECTS

### 1. Endangered species programme

#### 1. A study on the ecology, status and conservation perspectives of certain rare endemic avifauna of the Andaman & Nicobar Islands

Investigators	: Lalitha Vijayan & R Sankaran
Project staff	: K Sivakumar & V Murugan
Duration of the project	: 3 years
Commencement of project	: September 1995
Budget	: Rs.10,05,980/-
Funding Agency	: Ministry of Environment and Forests, Government of India

The project was initiated in September 1995 with the following objectives:

1. assess the status of endemic avifauna in the Andaman and Nicobar Islands and to identify the taxa which are rare, threatened or endangered
2. study the ecology of the Nicobar Megapode *Megapodius nicobariensis nicobariensis* and *M. n. alboti*, Narcondam Hornbill *Aceros narcondami* and Andaman Teal *Anas gähneri/rous albigularis*, and
3. prepare a conservation management plan for the rare endemic avifauna of the Andaman & Nicobar Islands

Two field camps were set up in December 1995; one in N Andamans for the Andaman Teal study and the other in Great Nicobar for the Megapode study.

The first phase of the project, an intensive survey was carried out to assess the status of avifauna, especially the endemic forms in the Andaman & Nicobar group of islands. This was followed by intensive studies on Andaman Teal, Narcondam Hornbill and Nicobar Megapodes. Highlights of the findings have been given in the earlier section.

The project is on a no-cost extension; the final report is being prepared and is expected to be published before March 2000.

## 2. Status survey and conservation planning for the Lesser Florican in western India

Principal Investigator	: Dr R Sankaran
Duration	: 7 months
Commencement	: July 1995
Budget	: Rs.35,000/-
Funding Agency	: Oriental Bird Club

Once the commonest and most widely distributed Indian bustard, the Lesser Florican *Symplectides indica* appears to be seriously threatened with extinction, as a result of the extensive changes in land use practices, particularly over-grazing of its grassland habitat.

SACON has developed a conservation programme for the Lesser Florican focussing mainly on protecting its essential grassland habitat, the grass 'beed'. It has also established a Florican Watch comprising people interested in the conservation of Florican.

## 3. Preparation of the Red Data Book for the Birds of Asia - India Chapter

National Co-ordinator	: Dr. V.S. Vijayan
Funding agency	: Environment Agency and Wild Bird Society of Japan
Duration	: Three years
Date of commencement	: February 1995

The project was initiated as a part of the Global Action Plan of the BirdLife International to produce a field guide for the managers involved in conservation of avifauna. The precise objectives of the book are:

1. identify and fully document all globally threatened species found in India,
2. identify the principal threats to these birds, and
3. indicate and prioritize action for all threatened species in terms of key sites, habitats and appropriate management.

The project was executed through a participatory programme involving ornithologists, both professional and amateur from different parts of the country. The threatened and near-threatened species of birds of India listed after discussions at the workshop at SACON in 1995 were taken up for preparation of species accounts by 27 ornithologists, both professional and amateur.

First draft of the report is ready and is being circulated to the authors for vetting. It is expected, a Red Data Book on Indian Birds, could be brought out during 2000-2001.

## 2. Environmental contamination and biodiversity

### 1. *Pesticide contamination in the Nilgiris district with special reference to select avifauna*

Principal Investigator	: Dr V S Vijayan
Co-investigator	: Dr S Muralidharan
Research Fellow	: Mr S M Murugavel (from 20 Nov '95)
Duration of the project	: Three years (Extended by one and half year)
Date of commencement	: August '94
Budget	: Rs.6,31,120/-

The major objective of the study is to assess the pesticide consumption and evaluate the level of contamination in various trophic levels in Nilgiri district with special emphasis on a select species of birds.

The first three phases of the project, namely reconnaissance survey and selection of sampling sites, collection of samples and laboratory analyses were completed. In the fourth phase the data are being compiled and analysed along with the analysis of some of the samples left over from the third phase.

The project is on a no-cost extension period and it is expected that the final report could be brought out by March 1999. Salient features of the findings have already been given in the former section of the report, under Environmental Contamination & Biodiversity.

### 2. *Heavy metal contamination in the fishes of Nilgiris district*

Principal investigator	: Dr S Muralidharan
Duration	: 2 1/2 years
Commencement of work	: November 1996
Funding agency	: SACON's seed money

This study attempts to estimate the level of metal contaminants, such as copper, zinc, cadmium and lead in the fishes of select high altitude reservoirs in Nilgiri district.

Six species of fishes were collected seasonally from the following reservoirs, Avalanche, Emerald, Kamaraj Sagar, Pykara, Upper Bhavani and Moyar-Maravakandy and Ooty lake. Data on the fishes from Upper Bhavani, Emerald and Pykara were presented earlier. Data gathered till date show varying levels of contamination. It is obvious that birds that feed in these water bodies will acquire the contaminants. Moreover, fishes harvested from these water bodies are sold to public in the market. Hence, it becomes imperative to find out the suitability of these fishes for human consumption in addition to birds which feed on them. Further sample analyses are in progress.

### *3. Accumulation of heavy metals in select species of birds in Nilgiri district*

Principal investigator	: Dr. S. Muralidharan
Project staff	: Mr. R. Jayakumar
Duration	: 1 1/2 years
Commencement of project	: September 1996
Funding agency	: SACON's seed money and Tamil Nadu State Council for Science and Technology

The study involves quantitative assessment of heavy metals in a few species of fish-eating and insectivorous birds in Nilgiri district. Concentration of metals such as copper, lead and zinc are being documented. A detailed account of results generated till-date is given in the earlier section. Further analyses of samples and compilation of data are in progress.

### **3. Man and biodiversity**

#### *1. The Impact of Rain Forest Fragmentation on the Herpetofauna and Small Mammals of the Western Ghats*

Investigators	: Ajith Kumar B.C.Choudhury (Wildlife Institute of India) Ravi Cheffam (Wildlife Institute of India)
Project staff	: Divya Mudappa, V.Karthikeyan and N.M.Ishwar
Budget	: Rs.45,00,000
Funding Agency	: US-India Fund (Through Wildlife Institute of India)

The loss of species owing to fragmentation of species-rich tropical rain forests is a matter of global concern. The goal this project is to examine the impacts of rain forest fragmentation in the Western Ghats on three taxa among which species richness and endemism are highest: the amphibians, reptiles and small mammals. The first phase of the project was a study on distribution of terrestrial rodents and shrews, amphibians, and reptiles in an undisturbed and contiguous rain forest. This study was carried out in the Kalakkad-Mundanthurai Tiger Reserve between May 1996 and January 1998. Results of this study were reported in the previous annual report.

In January 1998 we began the studies on amphibians and reptiles in the rain forest fragments in the Anamalai Hills, especially in Indira Gandhi Wildlife Sanctuary and adjoining areas. The sampling methods used included adaptive cluster sampling, forest and stream transects, and audio sampling for amphibians. Nearly 2000 quadrats, 300 transects and 50 hrs of audio recordings were carried out in 14 rain forest fragments. Several macro and micro habitat variables were also measured. These studies were



completed by June 1999 and analysis of data is in progress. During the same period, we also conducted studies on small carnivores in Kalakkad-Mundanthurai Tiger Reserve. The methods included telemetry studies, scat abundance estimation, scat analysis, and monitoring of phenology of fruit trees which are important to the small carnivores. Eight brown palm civets were radio-collared and tracked for up to 6 months.

In total nearly 45 species of amphibians were recorded from the Anamalai Hills. Of these, only about 10 species occur also in Kalakkad-Mundanthurai, confirming the prediction that was made using data from the Kalakkad-Mundanthurai Tiger Reserve that there was a high turn over of amphibian species across drainage and hill ranges. At least four new species (three tree frogs and one toad) have been collected which are now being described. Preliminary analysis of data shows that, even though very small fragments have few species, species richness in fragments is not simple function of fragment area. Nearly 40 species of reptiles were recorded from the Anamalai Hills, all of them also occurring in the Kalakkad-Mundanthurai Tiger Reserve. This also confirmed the prediction made with data from the Tiger Reserve that reptiles may not show a geographical turn over of species, but would show a turn over with altitude. As in the case of amphibians, reptile species richness also does not seem to be a simple function of fragment area.

In spite of considerable efforts, only one small carnivore, the Brown Palm Civet could be trapped and collared. Preliminary analysis of data shows that home range varies considerably (from 9 ha to as much as 56 ha), with the adult males having a much larger home range than that of the females. Nearly 90% of the scats of small carnivores collected in the Tiger Reserve consisted primarily of fruit remnants, showing the preponderance of fruit eaters (such as palm civets) in the community. Scats with mammalian hairs were very few, showing the very low abundance of small cats. Very low abundance of rodents and shrews, the major prey base of small cats, was evident from the study carried out in the previous year and might be a major reason for the low abundance of small cats. Camera trap studies show that the Brown Palm Civet is the most common small carnivore in the area.

Voluminous data collected so far are being analysed at present. A report on these two phases of this project is expected to be ready by June 2000. This would be followed by a survey of rain forest fragments in other parts of the Western Ghats in order to validate the findings.

## ***2. Impact of habitat alterations on the reptile diversity in the higher altitudes of the Nilgiri Biosphere Reserve, Western Ghats, India***

Principal Investigator	:	Dr. S. Bhupathy
Junior Research Fellow	:	Mr. K. Banugopan
Duration of the project	:	3 years
Date of commencement	:	March 1999
Budget	:	Rs. 4,00,300/-
Funding agency	:	Ministry of Environment & Forests, GOI (Biosphere Reserve Programme)

The Western Ghats have 161 species of reptiles of which about 89 (55%) are endemic. Despite higher species richness and endemism, no detailed studies have been made on the reptiles of the Western Ghats. As forestry and agricultural practices affect/ alter their habitats, such studies are quite relevant and necessary for forming long-term conservation programmes.

The montane shola and grasslands of the upper reaches of the Nilgiri Biosphere Reserve (above 2000m), have extensively been altered for raising plantations many of them are lost because of hydroelectric dams. This offers an opportunity to study and compare the faunal diversity changes in man modified habitats. In this background, a three year study was initiated in March 1999 with the following objectives: (1) to determine the distribution and abundance of reptiles in various natural and man-made habitats (2) to quantify the impact of habitat alteration on reptiles in terms of their abundance, and (3) to collect baseline data on their ecology especially on habitat requirements.

## ***3. Habitat monitoring of Bandipur National Park, Karnataka***

Principal Investigator	:	Dr. S. Narendra Prasad
Project staff	:	Mr. S. Swaminathan & Mr. K.K. Ramakrishnan
Duration of the project	:	3 years
Date of commencement	:	July 1994
Budget	:	Rs. 4,60,472/-
Funding Agency	:	Ministry of Environment & Forests, GOI

The project was undertaken with the following specific objectives:

1. change analysis of habitat using remote sensing and detailed ground based techniques,
2. evolve suitable field and remote sensing techniques for habitat/ wildlife population monitoring,
3. identification of permanent plots for monitoring, and
4. identification of suitable ecological indicators for monitoring.

The findings made till March 1999 have been given on the earlier section of the report. Data analysis is in progress. The project is running on a no-cost extension basis and is expected to be completed during 1999-2000.

#### 4. Ecology and conservation

##### 1. *Studies on hornbill-tree interactions with special reference to identification and conservation of "keystone mutualists" in the Nilgiri Biosphere Reserve*

Principal Investigator	: Dr. P. Balasubramanian
Research Fellow	: B. Maheswaram
Project duration	: Three years
Budget	: Rs. 3.82 lakhs
Date of commencement	: March, 1999
Funding agency	: Ministry of Environment & Forests, Govt. of India-Biosphere Reserve programme

Majority of the trees in tropical forests bear fleshy fruits adapted for consumption by vertebrate frugivores and many tropical vertebrates depend on fruits for food, at least part of the year. Plants that produce fruits during annual periods of fruit scarcity play an important role in maintaining the frugivorous animal populations and are called as "pivotal" plant species (Howe 1984), "keystone resources" (Terborgh 1986) and "Keystone mutualists" (Gilbert 1960). The identification of these "keystone species" has great conservation implications not only for the frugivores involved but also for the entire food web in an ecosystem.

Hornbills (Family: Bucerotidae) are one of the most important vertebrate frugivores in the tropical forests. They rely on figs and large-sized arillate fruits for food and big trees with large girth for nesting. Of the nine species of hornbills that occur in India, four species (Common Grey Hornbill *Tockus binnatus*, Malabar Grey Hornbill *Tockus griseus griseus*, Malabar Pied Hornbill *Anthracoceros orientalis* and Great Pied Hornbill *Buceros bicornis*) occur in the Western Ghats. Among these four, one is endemic and near threatened, two are threatened and only one is safe. The identification of fruit resources, particularly the keystone species utilized by hornbills is very essential for conserving this group of birds. Hence, the present study is undertaken in the Nilgiri Biosphere Reserve with the following objectives:

1. to document frugivory by hornbills and to identify the trees that are primarily dispersed by hornbills in the Nilgiri Biosphere Reserve,
2. to study the fruiting phenology of bird-dispersed trees and to find out the keystone species that support hornbills during a) lean season b) breeding season,

3. to document human threats to trees that are utilized by hornbills for feeding and nesting and to suggest conservation measures.

The study sites will be fixed after reconnaissance surveys in the Nilgiri Biosphere Reserve. Potential sites could be Upper Siruvani hills, Nilgiri hills and Silent valley.

## **2. The Distribution, Ecology and Conservation of the Small Carnivores in the Nilgiri Biosphere Reserve**

Principal Investigator	:	Ajith Kumar
Co-Investigator	:	N.Sivaganesan
Project staff	:	G.Umapathy
Budget	:	Rs.5,29,256
Funding Agency	:	Ministry of Environment and Forests, Government of India

Small carnivores are a species rich community in the Western Ghats, the ecology and conservation needs of which have not been studied to date. The goal of this project was to gather baseline information on the distribution of small carnivores in the Nilgiri Biosphere Reserve, and to assess the habitat use pattern and diet of some of the species. The results of the studies on distribution and diet were presented in the earlier annual reports.

In order to study habitat use, during 1998-99 we radio-collared three animals in the dry deciduous and thorn forests in Anakkatti, adjacent to our campus. Only two common mongooses and one small Indian civet were trapped, during 400 trap days, showing the very low capture rates for small carnivores. The trapped animals were fitted with radio-transmitters (Telonics Inc., MOD-125), and tracked with receiver (TR-4) and receiving antenna (RA-14K). Five to six bearings were taken in a night for 15-20 days each month following the release of the animals. The animals could be tracked only for four to five months, owing to the short battery life of the transmitters. The computer programme CALHOME was used to estimate home range (95% minimum convex polygon).

The monthly home range of the Small Indian Civet varied considerably, from 20.69 ha in to 102 ha. The home range over the four-months was 217.9 ha, thus showing very little overlap between monthly home ranges. The distance between successive daytime locations varied from 193.4 m to as high as 2260.8 m. The monthly and overall home ranges of the Small Indian Civet was lower than that of small Indian Civet and the Large Indian Civet and for two species of palm civets reported from more moist forests of Thailand. This might be partly due to the shorter period of tracking, only for four months of the Small Indian Civet, compared to 7 to 12 months for other species. The large differences between monthly home ranges and overall home range for all species show very little overlap among monthly home ranges. Thus, radio-tracking over a



longer period would have given a much larger overall home range for the Small Indian Civet. The Small Indian Civets are smaller than the species studied in Thailand and thus could have smaller home ranges.

One of the two radio-collared common Indian mongooses could be tracked only for 10 days when the collar stopped functioning. The other animal was tracked for four months. The monthly home range of the animal varied only from 3.4 ha to 4.9 ha, with an overall home range of 15.5 ha. The only other telemetry study on mongooses of the same genus, the Long-nosed Mongoose (*Herpestes naso*) in Congo basin, has reported much larger home ranges of up to 47.5 ha. As in the case of the civet, one reason for the smaller home range was that the animal was radio-tracked only for four months. As in the case of the Long-nosed Mongoose, the Common Indian Mongoose was also located most often along a stream, even though it moved away from it occasionally. There was no overlap between monthly home ranges, the overall home range being considerably larger than monthly home ranges.

The radio-telemetry studies on the small carnivores have given us the first estimates of home ranges of these species in India. The studies also highlight some of the major problems of telemetry studies such as very low capture rates and short battery life.

## 5. Environmental impact assessment

### 1. Rapid Environmental Impact Assessment of the proposed Puyankutty Hydroelectric Project, Kerala

Investigators	: P.A. Azeez & S. Bhupathy
Project Staff	: A. Rajasekaran, P.R. Arun, D. Stephen & P. Kannan
Date of commencement	: January 1998

The Kerala State Electricity Board (KSEB) proposed a hydroelectric project across the Puyankutty river. The KSEB requested SACON to undertake EIA study pertaining to biological environment. The scope of the study as per the terms of reference are the following: i) threatened plants and animals of the area and their endemism; is endemism with reference to Western Ghats, Kerala or to the specific forest facing submergence under the project?, ii) population studies of economic plants of the area and adequacy of mitigatory measures, iii) elephant population in the forest to be affected; their corridors, and the likely impact on them. Field surveys were undertaken from January 1998 to January 1999 to gather primary data; forty three localities were sampled covering both submersible (15 within the 28km<sup>2</sup>) and non-submersible areas (28) in about 314 km<sup>2</sup> area to generate data on the occurrence, distribution, abundance and status of various plant species and vertebrate taxa. Samplings were done in pre-monsoon, monsoon and post-monsoon seasons.

Puyankutty catchment is a mosaic of various types of forests: evergreen, semi-evergreen, and moist-deciduous, riverain, reed-brakes, grasslands and plantations. It also harbours over 300 species of vertebrates and many of them being endemic to the Western Ghats. Highlights of the findings have been given in the earlier section.

## **2. Environmental Impact Assessment of Human Rabies Vaccine Project, Human Biologicals Institute, National Dairy Development Board, Ooty - Phase II**

Investigators : P.A. Azeez, R. Sivakumar & S. Bhupathy  
Research Fellows : R. Mohanraj, D. Stephen & P. Karman  
Date of commencement : October 1997

The National Dairy Development Board proposed a new plant (Human Biologicals Institute) at Ooty to manufacture human rabies vaccine based on vero cell micro carrier technology, the technology currently in international practice. SACON was requested to conduct a Comprehensive Environmental Impact Assessment. Ten kilometre radial distance from the project site, assumed as the impact zone of this project were studied intensively.

As a part of the first phase i.e. Pre-installation stage, a study was undertaken, and report submitted during 1997-98. Salient findings are: The area is mostly agricultural land, human habitations, eucalyptus, wattle and social forestry plantations and built-up area. No wildlife sanctuary is present in the project location or its immediate vicinity. The HBI production unit, as per the project document, is not expected to release gaseous emissions in a level which may affect the fauna, flora and the people inhabiting the vicinity. The project requires approximately 20 m<sup>3</sup> / day of water and is expected to release almost the same amount of effluents which may contain organic load. However, sufficient treatment facilities including thermal sterilisation is envisaged in the project so as to meet the effluent quality as per the statutory regulations. In the second phase (i.e. post operation), all environmental parameters (air, water, soil, noise, flora and fauna) studied in the first phase were monitored and data analysed. The second and final report of this project is nearing completion.

## **3. Impact assessment of Vijayawada-Secunderabad petroleum product pipeline (Hindustan Petroleum Corporation Limited) on the flora and fauna**

Investigators : P.A. Azeez & S. Bhupathy  
Project Staff : A. Rajasekaran & R.R. Arun  
Date of commencement : January 1999

The Hindustan Petroleum Corporation Limited (HPCL) proposes to lay a 223km long pipeline from Vijayawada to Secunderabad, traversing three districts of Andhra

Pradesh, to transport petroleum products. SACON was requested to undertake the EIA pertaining to the flora and fauna. Field work is to be undertaken in April 1999.

## COMPLETED PROJECTS

### 1. Endangered species programme

#### 1. *The Prioritisation of Endangered Species of India*

Principal Investigator	:	Ajith Kumar
Collaborating Institution	:	Zoo Outreach Organisation, Coimbatore, and Conservation Breeding Specialist Group, India.
Budget	:	Rs.13,00,000
Funding Agency	:	Biodiversity Conservation Prioritisation Project, WWF-India

This project made an assessment of the conservation status of nearly 1500 animal and plant species in India, using the revised IUCN Criteria. Nearly 300 persons participated in the assessment, made through Conservation Assessment and Management Plan workshops held in different parts of India during 1996-97. This assessment brought to light the severe extinction risk faced by the small mammals and lower vertebrates in India. The lack of data, taxonomic expertise, and monitoring protocols, which make a systematic assessment of the lower organisms, became evident during the assessment. The major findings of the assessment were reported in the previous annual report. The final report of the project was submitted in May 1998. Highlights of the findings were given in the earlier section.

### 2. Man and Biodiversity

#### 1. *Status of Wildlife Corridors and their use by selected endangered mammals in the Nilgiri Biosphere Reserve, Southern India*

Principal Investigator	:	Dr. N Sivaganesan
Co-Investigator	:	Dr. Ajith Kumar
Duration of the project	:	2 1/2 years
Date of commencement	:	October 1994
Budget	:	Rs. 2,68,517/-
Funding Agency	:	Ministry of Environment and Forests, GOI

The objective of the project was to assess the quality and use by wild animals of habitat corridors in Tamil Nadu part of Nilgiri Biosphere Reserve. Eight crucial bottleneck corridors were identified in the study area. These are small in size with narrow width due to various development activities and human dependence for subsistence. The

habitat quality (tree density, and ground cover) of these was assessed in order to derive corridor specific management options. Majority of the corridors were highly used by animals during summer. Specific management measures for conservation of the corridors and also the endangered mammals using them were suggested. The importance of corridors linking managed forests and protected areas was also brought out which included tracking of movement pattern of animals between Western Ghats and the Eastern Ghats. Acquisition of private areas bordering crucial corridors in the district of Coimbatore and in Sathyamangalam was suggested to the forest department. Management strategies for conservation of corridors were suggested based on ecological studies on selected mammals. The project was continued on a no-cost extension basis till the study was completed.

## 2. *People's participatory approach for the conservation of wildlife corridors in the Nilgiri Biosphere Reserve, Southern India - Studies on Sujalkuttai-Bannari Corridor*

Investigators	: Dr. N Sivaganesan Mr. A O Linatushi IFS
Duration of the project	: Two years & 2 months
Date of commencement	: October 1996
Budget	: Rs 4,25,270
Funding Agency	: UNDP/SGP-India

In order to protect the 7 km long habitat corridor linking Nilgiri Eastern slope with the Bannari reserve forests in Sathyamangalam Forest Division in the Nilgiri Biosphere Reserve from biotic pressure, a strategy was developed with inter-sectoral assistance from various government agencies. A committee comprising representatives from the forest department, villages and rural development agencies was constituted for launching alternate livelihood strategies. In total, 59 families who depended on the corridor for their sustenance were provided with alternate livelihood (milking cows and weaving units, on their choice) with the assistance from various government agencies. Land leased from PWD and Panchayat was distributed to the villagers for growing fodder. The District Rural Development Agencies provided infra structure facilities such as bore wells for irrigating the fodder land.

The project attained certain degree of success. The disturbances caused to the corridor by removing wood have been significantly reduced. The erstwhile wood collectors turned to weeds for domestic uses. These villagers have been given priority in various departmental jobs, and the project team is also approaching various other institutions to provide them with alternate jobs. The provision of livelihood schemes to a few forest dependent people has not created any negative impact on the corridor management so far, especially with reference to other stakeholders. The sustainability of the project depends upon the co-operation between forest authorities, local communities and other



government agencies. Efforts are being made to link up this project with the Tamil Nadu Afforestation Programme for sustainability of the project.

### ***3. Impact of human interference on the plant and bird communities in the Nilgiri Biosphere Reserve***

Investigators	: Dr Lalitha Vijayan Dr S N Prasad Dr P Balasubramanian
Project staff	: Dr N K Ramachandran Dr D Stephen Mr V Gokula Ms Maya Mahajan
Duration	: 3 Years
Commencement	: October 1993
Budget	: Rs. 11,90,432/-
Funding agency	: Ministry of Environment and Forests, Government of India

The Nilgiri Biosphere Reserve (NBR) has a long history of human interference through development projects such as hydroelectric dams, introduction of monoculture, expansion of agriculture and horticulture which have brought in substantial changes in the ecological scenario of the area. Impacts of these changes on the biotic communities have not been investigated in detail. Hence, a project was taken up with the following objectives:

1. to study the structure and function of bird and vegetation communities in different habitats and to assess the impact of disturbance on them in NBR.
2. to bring out the relation between bird-species diversity and habitat diversity.
3. to determine the status of endemic and rare species in different habitats in NBR and suggest conservation strategies

The general approach was to collect data on plant and bird communities from disturbed and rather undisturbed forests of various types such as shola, evergreen, moist deciduous, dry deciduous and scrub, and plantations in the same physiognomic settings.

Compilation of information on plants and birds from published literature and other sources were made. Some of the satellite imageries interpreted at the Institute of Remote Sensing, Dehra Dun were checked in the field.

Seasonal sampling of herbs and bird community from all the five forest types and also on breeding from three habitats was conducted. Foliage density at different strata of the canopy was measured at 250 points in both scrub and dry deciduous forests, and foliage height diversity was calculated in order to correlate this with bird diversity. Foraging methods of the 35 major species of the scrub and dry deciduous habitats were observed with details on the vertical strata and substrate from where food was collected.

Nest site characteristics of the major breeding birds and the same parameters from random sites were recorded in Mudumalai along with other relevant details of breeding, especially the impact of human interference. Detailed statistical analyses were done to find out the key factors determining the nest site selection of major species in the scrub and dry deciduous forests.

Disturbance factors such as distance from human settlements to the sampling area and movement of people, cutting and lopping signs, cattle head and tracts, grazing signs, and dung in the sampling area were recorded. Data on collection of firewood and its preference of trees were noted by analyzing the headloads and interviewing people. Abundance of snags in the study plots and their collection by people were also studied.

Information compiled on 2546 species of plants occurring in NBR showed 133 to be rare and 185 threatened. 366 of these species are endemic to the Western Ghats of which 70% are rare, 7% threatened, and the rest common. Most of them occur in the evergreen forests and many are herbs.

Other major findings have been reported in the earlier section. Recommendations for the management are given below:

### Recommendations

- \* Immediate measures are to be taken to reduce pressure from cattle grazing, firewood collection, and felling of trees.
  - i. High milk-yielding stall-fed varieties of cattle should be provided to villagers who let in cattle inside the forests
  - ii. Facilities for growing fodder should be provided.
  - iii. Dung collection from the Mudumalai Wildlife Sanctuary area should be stopped.
  - iv. Firewood depots and biogas plants may be set up for providing cooking fuel to the local people.
  - v. Eco-development programmes may be initiated encompassing all the above.
- \* Proper regulation of extraction of Non-Timber Forest Produces (NTFP) by local/tribal people needs to be implemented.

- \* Participatory Management Techniques for wildlife habitat protection, restoration and use be initiated; also provide alternate livelihood for the local villagers who depend on the forests.
- \* Scrub forests of Sigur Reserve forest may be included in the Mudumalai sanctuary for better protection.
- \* No further expansion of plantations and conversion of grasslands and shola forests in the Upper Nilgiris should be permitted.
- \* Long-term monitoring of vegetation and bird communities may be carried out along with intensive studies on the biology of rare and habitat specialist birds.
- \* Database needs to be set up with the digital data and GIS with the available information on flora and fauna.

### 3. Ecology and conservation

#### 1. *Ethnobotany and phytochemistry of medicinal plants in the Nilgiri Biosphere Reserve*

Principal investigators	: S. Narendra Prasad P. Balasubramanian
Senior Research fellow	: A. Rajasekaran
Duration of the project	: Three years
Commencement of project	: February 1994
Budget	: Rs. 4, 49,000/-
Funding agency	: Ministry of Environment & Forests, Govt. of India

Most of the ethnobotanical studies conducted in the Nilgiri Biosphere Reserve deal with listing of plants used by the tribals, the parts of the plant used and the type of the disease cured. These studies do not cover ecological aspects which are vital for the conservation and sustainable use. Another important dimension with ramification in Intellectual Property rights (IPR) related issues is the information on chemical component of these plants. Phytochemical properties of most of the plants are still unknown comprehensively. Hence, the present study was taken up with the following objectives:

1. study the status, distribution and regeneration of medicinal plants among the diverse vegetation types in the Nilgiri Biosphere Reserve,
2. generate ethnobotanical information as comprehensive as possible by surveying select tribal groups in the Nilgiri Biosphere Reserve

3. carry out a preliminary phytochemical analysis of four to six medicinal plant species hitherto not investigated.

The results have been summarised under an earlier section of the report. The project had a no-cost extension to completed the work.

#### **4. Environmental Impact Assessments**

##### ***1. Rapid Environmental Impact Assessment of Ultimate Alloys (P) Ltd, Coimbatore***

Investigators	: P.A. Azeez, R. Sivakumar & S. Bhupathy
Projects staff	: D. Stephen, R. Mohanraj & P. Kannan
Date of commencement	: August 1998
Date of completion	: January 1999

The salient features of the findings have been given in the earlier section on EIA.

##### ***2. Rapid Environmental Impact Assessment of Sauer's Alloys (P) Ltd, Coimbatore***

Investigators	: P.A. Azeez, R. Sivakumar & S. Bhupathy
Project Staff	: D. Stephen, R. Mohanraj & P. Kannan
Date of commencement	: June 1998
Date of completion	: March 1999

The salient features of the findings have been given in the earlier section on EIA.

### **EXTENSION ACTIVITIES**

#### **1. Nature awareness programme for children**

The major extension activity of the year was the programmes organized to create nature awareness among school children, along with the 102<sup>nd</sup> Birth Anniversary Celebrations of late Dr Salim Ali.

Competitions on essay writing, elocutions, painting and quiz on natural history subjects were conducted for the school children of the following categories:

- Standard : VI - VIII
- Standard : IX - X

Winners (first, second and third) were awarded with attractive prizes, all books related to natural history, and a certificate. The school which received maximum points was



honoured with the "Salim Ali Memorial Rolling Trophy" which we instituted in 1994. Chinmaya Vidyalaya, Vadavalli, Coimbatore bagged the Trophy for the year as their students excelled others in the various competitions.

The Trophy was awarded at a simple function organized on 12 November 1998, the birthday of Dr Salim Ali, at the State Forest Service College, Coimbatore. The function was presided over and the award was given away by Dr Rajammal P Devadass, Chancellor, Avinashilingam Deemed University for Home Science and Higher Education for Women. Dr Balakrishna Ilango, Vice Chancellor, Bharatiya University spoke at the occasion highlighting the role of birds in natural ecosystems and the need to conserve them.

## **2. Salim Ali Memorial Lecture**

The Salim Ali Memorial lecture of the year was delivered by Dr Abdul Kareem, Vice Chancellor, Tamil Nadu Agricultural University. He emphasised the need for replacing chemical fertilizers and pesticides with bio products and also, the harmful impacts of the existing pesticides on avifauna.

## **3. Training in bird watching and methods of field work**

We organized a capsule programme for the Ranger Trainees of the Andaman Forest Department for identification of birds and methods for field work in marshes. The training was conducted at Katakatchang, South Andamans.

Another bird watching training programme was conducted for the students of Zoology Department, Nehru Rashtriya Mahavidyalaya, Port Blair. The students accompanied by a teacher were taken to the Mahatma Gandhi Marine National Park, South Andaman.

## PUBLICATIONS

### Papers published

Balasubramanian, P. & A. Rajasekaran (1998). Utilization of wild plants by tribal communities in Sathyamangalam Forest division, Eastern Ghats, pp. 335-344. In: *Proceedings of the Seminar on Conservation of Eastern Ghats, EPTRI, Hyderabad.*

Balasubramanian, P., A. Rajasekaran & S. N. Prasad (1998). Ethnobotany and phytochemistry of medicinal plants in the Nilgiri Biosphere Reserve, pp. 149-154. In: (Eds. Maikhuri, Rao & Rai) *Biosphere Reserves and Management in India*, Govt. of India.

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Kumar, A. & G.Sakthivelou (1998) Temporary group splitting in the lion-tailed macaque *Macaca silenus* in forest fragment in Indira Gandhi Wildlife Sanctuary, Tamil Nadu. *Journal of the Bombay Natural History Society*, 95:422-425 (with).

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Prasad, S.N. (1998). Conservation planning for the western Ghats of Kerala: II. Assessment of habitat loss and degradation. *Current Science* 75(3):228-235.

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Senthilanthan, S. and P.A. Azeez (1999). Water quality of effluents from dyeing and bleaching industries in Tirupur, Tamilnadu, India. *J. Industrial Pollution and Control*. 15:77-86

### In press

Balasubramanian, P. & A. Rajasekaran (in press). Documentation of ethnobiological knowledge of the tribals in Sathyamangalam Forest division, Nilgiri Biosphere reserve. Proceedings of the Seminar on Wildlife research in Nilgiri Biosphere Reserve, Tamil Nadu Forest Dept.

Balasubramanian, P. & A. Rajasekaran (in press). Status and ecology of medicinal plants in the Nilgiri Biosphere Reserve. *Proceedings of the Seminar on Wildlife research in Nilgiri Biosphere Reserve*, Tamil Nadu Forest Dept. With

Balasubramanian, P. (in press). Avian frugivory and seed dispersal in a dry mixed deciduous forest in Southern India. Proceedings of the First Pan Asian Ornithological Congress, SACON.

Kumar, A. & Unapathy, G. (in press). The occurrence of arboreal mammals in the rain forest fragments in the Anamalai Hills, South India. *Biological Conservation*.

Kumar, A. (in press). Sexual harassment among female lion-tailed macaque *Macaca silenus* in the wild. *Journal of the Bombay Natural History Society*.

Sivakumar, R., R. Mohanraj & P.A. Azeez (in press). Physicochemical analysis of water at high altitude sources of Ooty. *Pollution Research*.

Vijayan, L. & Gokula, V. (in press). Impact of human interference on some rare endemic birds in the Upper Nilgiris, Tamil Nadu. Proc. National seminar on endemic and endangered plant and animal species of Eastern and Western Ghats, 22-23 March, 1999, Chennai. Tamil nadu Forest Department. (12 pages).

### Communicated

Arur, P.R. & P.A. Azeez (communicated). On the butterflies of Puyankutty forests, Kerala, India. *Indian Journal of Forestry*

Gokula, V. & Vijayan, L. (communicated). Foraging guild of birds in the thorn forest in Mudumalai Wildlife Sanctuary, Tamil Nadu. *Curr. Science*.

Gokula, V. & Vijayan, L. (communicated). Nesting and Foraging behaviour of the Paradise Flycatcher, in Mudumalai WLS, Tamil Nadu, South India. *IBNH5*.

Kumar, A., Ishwar, N.M. & Chellam, R. (1998). The distribution of arboreal reptiles in the rain forests of the Western Ghats. *Proc. National Wildlife Seminar*, Wildlife Institute of India, Dehra Dun. August 1998.

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Kumar, A. & Umapathy, G. (1998). The feeding ecology of the Nilgiri langur (*Trachypithecus jentinkii*) in fragmented habitats. *Proc. National Wildlife Seminar*, Wildlife Institute of India, Dehra Dun. August 1998.

Kumar, A. & Prabhakar, A. (1999). Community structure in terrestrial small mammals in rain forest fragments in the Anamalai Hills, South India. *Journal of Tropical Ecology* (under revision).

Kumar, A. & with Umapathy, G. (1999). Demography of the lion-tailed macaque in rain forest fragments in Anamalai Hills in the Western Ghats, South India. *Primates* (under revision).

Kumar, A. & Umapathy, G. (1999). Impacts of habitat fragmentation on the Malabar giant squirrel (*Ratufa indica*) in rain forests of Anamalai Hills in the Western Ghats, South India. *Biotropica* (under review).

Kumar, A. & Umapathy, G. (1999). Impacts of habitat fragmentation on the time budget and feeding ecology of lion-tailed macaque (*Macaca silenus*) in rain forest fragments of Anamalai Hills, South India. *American Journal of Primatology* (under revision).

Kumar, A., Mudappa, D.M. & Chellam, R. (1999). Microhabitat selection in the Malabar spiny dormouse (*Platacanthomys leuromus*) in the Kalakkad Mundanthurai Tiger Reserve. *Curr. Sci.*

Kumar, A. & Prabhakar, A. (1999). The demography of terrestrial rodents and shrews in rain forest fragments in the Anamalai Hills, South India. *Journal of Zoology* (under revision).

Kumar, A., Vasudevan, K. & Chellam R. (1999). The distribution of forest floor amphibians in the rain forests of the Kalakkad-Mundanthurai Tiger Reserve. *Current Science*.

Kumar, A., Ishwar, N.M. & Chellam R. & Choudhury, B.C. (1999). The distribution of forest floor reptiles in the rain forests of the Kalakkad-Mundanthurai Tiger Reserve. *Current Science*.



Mohanraj, R., Maya V Mahajan & P. A. Azeez (communicated). Distribution of select heavy metals in moist deciduous forest of Siruvani hills, Southern Western Ghats, India, *Indian J Forestry*.

Mohanraj, R., P.A. Azeez & R. Sivakumar (communicated). An assessment of ambient noise levels in Coimbatore city. *Indian J. Environmental Health*.

Sivakumar R., Mohanraj, R. and P.A. Azeez (communicated). Water quality of Mudumalai Wildlife Sanctuary, Tamil Nadu. *International Journal of Ecology, Environment and Conservation*.

### REPORTS/DISSERTATIONS

Azeez, P.A., R. Sivakumar, S. Bhupathy, D. Stephen, P. Kannan & R. Mohanraj (1999). Rapid Environmental Impact Assessment of Saneer's Alloys (P) Ltd.

Azeez, P.A., S. Bhupathy, A. Rajasekaran & P.R. Arun (1999). Impact Assessment of Vijayawada - Secunderabad Petroleum Product Pipeline (Hindustan Petroleum Corporation Limited) on the Flora and Fauna.

Azeez, P.A., S. Bhupathy, A. Rajasekaran, P.R. Arun, D. Stephen & P. Kannan (1999). Rapid Environmental Impact Assessment of the proposed Puyankutty Hydroelectric Project, Kerala.

Azeez, P.A., R. Sivakumar, S. Bhupathy, D. Stephen, P. Kannan & R. Mohanraj (1999). Rapid Environmental Impact Assessment of Ultimate Alloys (P) Ltd.

Balasubramanian, P., S. N. Prasad & K. Kandavel (1998). Role of birds in seed dispersal and natural regeneration of forest plants in Tamil Nadu. *SACON Technical Report no. 7*.

Balasubramanian, P. & N. Sivaganesan (1999). Food plants of wildlife in the Coimbatore Forest Division. *Report submitted to Tamil Nadu Forest Department*.

Prabhakar, A. (1998). Impacts of Habitat Fragmentation on the Terrestrial Small Mammal Communities in the Tropical Rain Forest of the Anamalai Hills in the Western Ghats, South India. Ph.D.dissertation to Bharathiar University, Coimbatore. (Guide Ajith Kumar).

Prasad, S.N., P. Balasubramanian & A. Rajasekaran. Ethnobotany and phytochemistry of medicinal plants in Nilgiri Biosphere Reserve, Final Report, Ministry of Environment and Forests, Government of India.

Prasad, S.N., Vijayan, L., Santharam, V., Johna, J., Balachandran, S., Ronald, J., Verghese, C.P.A., Sivakumar, R., Ramakrishnan, K.K., & Ramachandran, V.S. (1998). Conservation planning for the western Ghats of Kerala.

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Sivaganesan, N. (1998). Acquisition of crucial private lands for corridor management in the Nilgiri Biosphere Reserve. Occasional report submitted to the Sub-Committee, Ministry of Environment & Forest, Government of India

Sivaganesan, N. (1998). Elephant Census - April 1998- In Coimbatore Forest Division, SACON - Occasional Report - Submitted to the Tamil Nadu Forest Department (Coimbatore Forest Division).

Sivaganesan, N. & Balasubramanian, P. (1998). Workshop manual (Region I; Forest Ranges of Boluvampatti, P N Palayam, Karamadai and Coimbatore) for censusing elephants and identification of food plants of vertebrates - Submitted to the Coimbatore Forest Division, Tamil Nadu Forest Department (20 February 1998).

Sivaganesan, N. & Balasubramanian, P. (1998). Workshop manual (Region II; Forest Ranges of Mettupalayam ) for censusing elephants and identification of food plants of vertebrates - Submitted to the Coimbatore Forest Division, Tamil Nadu Forest Department (23 February 1998).

Sivaganesan, N. & Ramakrishnan, B. (1999). Status of elephant corridor between Nilgiri Eastern slope reserve forests and Coimbatore Forest Division linking with the Silent valley National Park in the Nilgiri Biosphere Reserve - Occasional report. Submitted to the Salim Ali Nature Conservation Fund, Bombay Natural History Society.

Vijayan, L., Prasad, S.N., Balasubramanian, P., Gokula, V., Ramachandran, N.K., Stephen, D. & Mahajan, M.V. (1999). Impact of human interference on the plant and bird communities in the Nilgiri Biosphere Reserve.

## LECTURE /TALK DELIVERED

Balasubramanian, P. "Importance of Biodiversity Conservation", interview and discussion with Dr. A. Natarajan through AIR, Coimbatore.

Balasubramanian, P. "Role of birds in preserving biodiversity", talk given through AIR, Coimbatore. 22 February 1999.

Vijayan, L. The Andaman avifauna: status, research, and conservation. Lecture at the Ranger Training School, Andaman Forest Department, Wimberlygunj, S. Andaman. 30 September 1998.

## MEETINGS/SEMINARS/WORKSHOPS/PAPER PRESENTED

Azeez, P.A., R. Sivakumar & R. Mohanraj (1998). Urban Coimbatore: Environmentally unfriendly. State level seminar on environmental problems in urban area. April 17-18, Department of Geography, Government Arts College, Coimbatore.

Balasubramanian, P. Attended the National Seminar on endangered and endemic plants and animals in Western and Eastern Ghats, organized by the Tamil Nadu Forest Department (22 and 23 March 1999).

Kumar, A. Brainstorming meeting on methods for survey of biodiversity, Gujarat Ecology Commission, Baroda, December 22, 1998.

Kumar, A. Conservation status of the Indian Primates. Talk at the 17<sup>th</sup> Congress of the International Primatological Society, Madagascar, August 10-14, 1998.

Kumar, A. Demography of the lion-tailed macaque in fragmented habitat. Paper presented at the 17<sup>th</sup> Congress of the International Primatological Society, Madagascar, August 10-14, 1998.

Kumar, A. & Umapathy, G. Ecology and demography of lion-tailed macaque in fragmented habitat. Paper presented at the National Seminar on Endemic and Endangered Plants and Animal Species of the Eastern and Western Ghats, Tamil Nadu Forest Department, Chennai, March 22-23, 1999.

Kumar, A. Ecology of small mammals in Kalakkad-Mundanthurai Tiger Reserve. Talk at the Review Meeting of US-India funded projects in the Wildlife Institute of India, New Delhi, October 14, 1998.

Kumar, A. & Umapathy, G. Impacts of habitat fragmentation on the demography of the lion-tailed macaques in rain forest fragments of Anamalai Hills, Western Ghats, South

India. Paper presented at the 5<sup>th</sup> International Symposium on the Lion-tailed Macaque, Mysore, January 11-14, 1999.

Kumar, A. Inaugural meeting of the Indian Society of Ecological Economists, Institute of Economic Growth, New Delhi, September 24, 1998.

Kumar, A. Life history and ecology of the lion-tailed macaque in the wild. Talk given at the German Primate Center, Göttingen, Germany, March 12, 1999.

Kumar, A. & Umapathy, G. The abundance of arboreal squirrels in forest fragments in the Anamalai Hills. Paper presented at the National Seminar on Endemic and Endangered Plants and Animal Species of the Eastern and Western Ghats, Tamil Nadu Forest Department, Chennai, March 22-23, 1999.

Kumar, A. The prioritisation of endangered species. Talk at the International Seminar, Biodiversity Conservation Prioritisation Project, WWF-India, New Delhi, April 28-30, 1998.

Kumar, A. & Umapathy, G. Time budget and feeding ecology of lion-tailed macaque in four rain forest fragments of Anamalai Hills, South India. Paper presented at the 5<sup>th</sup> International Symposium on the Lion-tailed Macaque, Mysore, January 11-14, 1999.

Kumar, A. Two decades of field research on the lion-tailed macaque. Talk at the 5<sup>th</sup> International Symposium on the Lion-tailed Macaque, Mysore, January 11-14, 1999.

Muralidharan, S. Environmental contaminants and their impact on a wetland ecosystem. Seminar on wildlife conservation: perspective and retrospective, 2 March 1998, A V C College Mayiladuthurai.

Muralidharan, S. (1998). Organochlorine residues in the egg: impact on bird populations. In: Manual of the training course on insecticide toxicology, 4-18 November '98, Tamil Nadu Agricultural University, Coimbatore.

Satheeshkumar, M., R. Mohanraj, P.A. Azeez & R. Sivakumar (1999). Heavy metal levels in wetland surface waters of Coimbatore city, Tamilnadu, India. International Workshop on environmental impacts of metals, Tamil Nadu Agricultural University and Soil Contamination Research in Asia and Pacific, Australia.

Senthilnathan, S. & P.A. Azeez (1999). Heavy metals concentration in the water of river Noyyal, Tirupur, Tamil Nadu, India. International Workshop on environmental impacts of metals, Tamil Nadu Agricultural University and Soil Contamination Research in Asia and Pacific, Australia.



Senthilnathan, S., R. Sivakumar & P.A. Azeez (1998). Urban Tirupur: Environmentally hazardous. State level seminar on environmental problems in urban area, April 17-18, Department of Geography, Government Arts College, Coimbatore.

Sivaganesan, N. (1999). Significance of reserve forests and management strategies for them to conserve wildlife fauna in the Nilgiri Biosphere Reserve. In: Proceedings of the National Seminar on Endemic and Endangered plant and animal species of Eastern and Western Ghats. Organized by the Tamil Nadu Forest Department (Research Wing), Chennai (23 -24 th March 99).

Sivaganesan, N. Attended three meetings of the Sub-Committee of the Indian Wildlife board for "Bird Trade and Trapping" July-August 98 and presented a talk for the committee members on "Alternate livelihood and conservation strategies for protected area management".

Sivaganesan, N., Limatoshi, A.O. & Sivasubramanian, G. (1998). People Participatory approach for conservation of elephant corridor - A case study in the Nilgiri Biosphere Reserve. In Proceedings of the Workshop on Eco-Documentation, -Social, institutional, Legal, and Policy issues- Organized by the Wildlife Institute of India, Dehradun (24-26 November 1998).

Sivaganesan, N., Limatoshi, A.O. & Sivasubramanian, G. (1998). Community participatory programme for the conservation of elephant corridor in the Nilgiri Biosphere Reserve, Southern India - A case study. In, Proceedings of the National seminar on wildlife conservation, research and management, Wildlife Institute of India, (10-13 August 1998) Dehra Dun.

Sivakumar, R., R. Mohanraj & P.A. Azeez (1996). Air pollution scenario in Coimbatore. State level seminar on environmental problems in urban area, April 17-18, Department of Geography, Government Arts College, Coimbatore.

Sivakumar, R., P.A. Azeez & R. Mohanraj (1999). Heavy metals analysis of high altitude water sources, Ooty, South India. International Workshop on environmental impacts of metals, Tamil Nadu Agricultural University and Soil Contamination Research in Asia and Pacific, Australia.

Vijayan, L. National seminar on endemic and endangered plant and animal species of Eastern and Western Ghats, 22-23 March, 1999, Chennai. Tamil nadu Frest Department. Presented a paper on "Impact of human interference on some rare endemic birds in the Upper Nilgiris, Tamil Nadu".

Vijayan, L. State level workshop on setting forestry research priorities. 12-13 October 1998. Port Blair Forest Dept. of Andaman and Nicobar Islands & ICFRE (presented the

paper on "Research and priorities for research of SACON in the Andaman and Nicobar Islands".and participated in the workshop).

### POPULAR ARTICLES

Sivaganesan, N. (1998). This 'corridor' needs protection - *The Hindu*, September 5<sup>th</sup>.

Sivaganesan, N. (1998). Tree Cutters become Conservationists, *The Hindu*, 8th December 1998.

Sivakumar, R. & P.A. Azeez (1999). Water Pollution in Tirupur. *The Hindu - Science & Technology*, 18 February 1999.

### CONTRIBUTION TO BOOKS

Sivakumar, R. & P.A. Azeez (1999). Need for low cost effluent treatment systems for dyeing and bleaching industries at Tirupur. Chapter submitted to the book 'Low cost technologies of effluent treatment systems' published by Enviromedia, India.

### UNIVERSITY DEPARTMENT

SACON has been affiliated to the Bharathiar University for conducting M.Phil and Ph.D. programmes since 1994 and all Scientists have been recognized as guides in the departments of Zoology, Botany and Environmental Science of the University. Eight students have been enrolled for Ph.D. programme. Names of the guides and students and the topic of research are given below:

Name of Guide & Department	Name of student	Course	Topic of research
Dr V S Vijayan (Zoology & Env. Sciences)	Mr P R Arun	Ph.D	Seasonality and abundance of insects with special reference to Lepidoptera in a Moist Deciduous Forest at Siruvani
Dr Lalitha Vijayan (Zoology & Env. Sciences)	Mr V Gokula	Ph.D	Bird communities in the thorn and dry deciduous forests of Mudamalai Wildlife Sanctuary, South India.
	Sr. T. Nirmala	Ph. D. (FIP,U GC)	Bird communities in the Anaikatty Hills
	Mr C Venkatraman	Ph.D	Breeding biology of selected species of birds at Siruvani in the Nilgiri Biosphere Reserve

Name of Guide & Department	Name of student	Course	Topic of research
Dr S N Prasad (Botany)	Mr A Rajasekaran	Ph.D	Ecology and utilization of medicinal plants with special reference to select tribal groups in the Nilgiri Biosphere Reserve
Dr Ajith Kumar (Zoology)	Mr R Krishnamani	Ph.D	The ecology of seed dispersal by the Lion-tailed Macaque in Someshwara Wildlife Sanctuary, Karnataka
	Mr G Umashathy	Ph.D	Impact of rainforest fragmentation on arboreal mammals of the Anamalai Hills, Western Ghats, South India
	Mr A Prabhakar	Ph.D	Rainforest fragmentation and its impact on small mammal community in the Indira Gandhi Wildlife Sanctuary, Tamil Nadu
Dr P A Azeer (Env. Sciences)	Mrs Maya Mahajan	Ph.D	Colonization of selected weeds in different vegetation types
	Mr R Mohanraj	Ph. D.	Air pollution in Coimbatore with impleins on RSPM and its health implications
		M.Sc. *	Chemical fractionation of heavy metals in sediments of select wetlands in Coimbatore city
		M.Sc. *	Ambient air quality and Noise levels in and around Coimbatore city
		M.Sc. *	Assessment of water quality of select wetlands in Coimbatore City
Dr S Muralidharan	Mr R Jayakumar	M.Sc.*	Accumulation of heavy metals in select species of birds in the Nilgiris district

\* M.Sc. dissertation

## **ASSOCIATE MEMBERSHIP**

Associate Membership of SACON is offered to interested persons on the following terms and conditions:

Associate Membership shall be opened to those who are interested in ornithology, natural history, biodiversity conservation and environmental protection,

Application for Associate Membership should be recommended by a member of the Governing Council,

Associate Members can attend the Annual General Meeting of the Society. However, they will not have any voting right.

### **PRIVILEGES OF ASSOCIATE MEMBERS**

SACON Newsletters - free of cost  
participation in co-ordinated projects such as National Bird Census and Wetland  
attending nature camps organized by SACON  
library facilities at SACON  
attending seminar and symposia organized by SACON

No particular initiative was taken to enroll members to the SACON society during the year because of the lack of infrastructural facilities.

## INFRASTRUCTURE

### Permanent campus

SACON has been functioning from rented buildings at Kalampalayam, 9 km west of Coimbatore ever since it commenced its activities in 1991. The year heralded a change in working atmosphere. We shifted the office to the newly constructed building in our permanent campus at Annakatty. 3700 sq. ft area has been built up, in six separate blocks; administrative block (with all common facilities such as computer rooms, GIS-Remote Sensing and museum), library, laboratory, hostel for eight students, mess hall and quarters for two attendants.

### Laboratory facilities

No additions could be made to the following existing equipment in the ecotoxicology laboratory.

- Atomic Absorption Spectrophotometer (AAS)- Perkin-Elmer, Model 3300 with 13 lamps for analyzing metal contamination.
- Mercury Hydride Generator-Perkin Elmer for analyzing mercury and other hydride forming elements.
- Gas Chromatography (GC) - Hewlett Packard Model 5890 Series II with three detectors, namely Electron Capture Detector (ECD), Nitrogen Phosphorous Detector (NPD) and Flame Photometric Detector (FPD) for analyzing pesticide residues.
- Microwave Digestion System-Milestone Model 1200 for digesting tissues for analysis in the AAS.
- High volume air sample for analysing suspended particulate matters (spar), oxides of Nitrogen(NO<sub>x</sub>) and Sulphur (SO<sub>x</sub>).

Laboratory has also been equipped to monitor air quality, water and soil.

### Computer facilities

Computer system has been completely revamped, replacing the UNIX environment with Pentium PCs. Each Scientist has been provided with a Pentium PC. LAN is being contemplated.

### Library

Addition to the library during 1998-99 was 79 books, 10 technical reports and 69 volumes of periodicals, of which 35 are Indian and 34 are foreign. Total holdings now include 1875 books, 249 technical reports and 1846 back volumes of journals.



## STAFF OF SACON

### Scientific

Director	Dr. V.S. Vijayan
Avian Ecology	Dr. Lalitha Vijayan, Dr. Ravi Sankaran
Conservation Biology	Dr. Ajith Kumar, Dr. N. Sivaganesan
Terrestrial Ecology	Dr. S.N. Prasad Dr. P.Balasubramanian
Wetland Ecology	Dr. H.S. Das
Ecotoxicology	Dr. S. Muralidharan
Environmental Impact Assessment	Dr. P.A. Azeez, Dr. S. Bhupathy Dr. R. Sivakumar
Library & Information	Dr. E. Johnsen, Mr. M.P. Sampath Kumar

### Administrative

Administrative Officer	Mr. Syed Shuhameer
Finance Officer	Mrs. Jayashree Muralidharan
PA to Director	Mr. V. Vaidyanathan
Administrative Assistant	Mr. M. Venkkrishnan
Accounts Assistant	Mr. S.N. Krishnamoorthy
Office Assistant	Ms. A. Jothisree
Stenographer	Mr. Leon Felix
Site Engineer	Mr Ibrahim Kutty

## APPENDIX I. MEMBERS OF SACON SOCIETY

**Mr B G Deshmukh, IAS (Retd)**

**President- SACON**

**TATA Sons Limited, Bombay House  
Fort, Mumbai - 400 001**

**Mr Vishwanath Anand IAS**

**Chairman - SACON (up to August 1998)**

**Secretary to the Govt. of India**

**Ministry of Environment and Forests**

**Govt of India, Paryavaran Bhawan**

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**Mr Vinod Vaish IAS**

**Chairman- SACON (from September 1998)**

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**Mr P K Brahma IAS**

**Jt. Secretary and Financial Adviser (up to November 1998)**

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**Mr K S Sripathi IAS,**

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**Wildlife Institute of India**

**P.B. No. 18, Chandrabani**

**Dehradun - 248 006**

**Mr J Daniel**

**Honorary Secretary**

**Bombay Natural History Society**

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**Director**

**Bombay Natural History Society**

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Additional Director  
Wildlife Institute of India  
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Dr Rahgavendra Gadagkar  
Chairman  
Centre for Ecological Sciences  
Indian Institute of Sciences  
Bangalore - 560 012

Mr V C Sacheti,  
Principal Chief Conservator of Forests  
Govt of Rajasthan, Van Bhawan,  
Jaipur 302 005

Mr G P Shukla IFS  
Principal Chief Conservator of Forests  
Andaman and Nicobar Islands, complex  
Van Sadan  
Port Blair - 744 102

Dr Pratap Saraiya  
12-B Suneeta  
B G Kher Marg  
Mumbai - 400 006

Mr Cyrus Guzder  
Airfreight Pvt. Ltd  
Neville House, Ground Floor  
Currimbhoy Road, Bellard Estate  
Mumbai - 400 036

Dr B F Chhappar  
E/31 Currow Baug  
Colaba Causeway  
Mumbai - 400 005

Dr M S Swaminathan  
M S Swaminathan Research Foundation  
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Taramani Institutional Area  
Chennai - 600 113

Dr D K Lahiri Choudhury  
45 Subhasini Ganguly Sarani  
Calcutta - 700 025

Mr C P Oberoi,  
Inspector of General of Forests  
Min of Environment and Forests,  
Paryavaran Bhawan, CGO Complex  
New Delhi

Mr S R Mehta IFS  
Principal Chief Conservator of Forests  
Govt of Arunachal Pradesh  
Itanagar - 791 111

Mr A P Mishra IFS  
Principal Chief Conservator of Forests  
Govt of Gujarat  
Gandhi Nagar 380 022

Mrs D S Variava  
Director,  
Bharat Tiles  
32-B Samachar Marg  
Mumbai - 400 023

Mr K P Karanichandani  
503 Atul Terrace  
Coffe Parade, Colaba  
Mumbai - 400 005

Dr Hari Gautam  
Vice Chairman  
University Grants Commission  
Bahadurshah Zafar Marg  
New Delhi - 110 002

Dr H Y Mohan Ram  
INSA Senior Scientist  
194, SFS, DDA Flats  
Mukherji Nagar  
Delhi - 100 009

Dr T N Khoshoo  
Honorary Distinguished Fellow  
Tata Research Institute, Darbari Seth Block  
Habitat Place, Lodi Road  
New Delhi - 110 003

Dr S Z Qasim  
A - 15, Defence Colony  
New Delhi - 110 024

Dr M K Ranjitsinh IAS (Retd)  
Worldwide Fund for Nature India  
172-B, Max Muller Marg  
Lodi Estate  
New Delhi - 110 003

Dr Madhav Gadgil  
Centre for Ecological Sciences  
Indian Institute of Science  
BANGALORE - 560 012

Prof. B L Deekshatulu  
Director  
Centre for Space Science & Technology &  
Education  
in Asia and the Pacific (CSSTE-AP)  
IRS Campus, P B No. 222  
Dehradun 248 001

Dr P Khanna  
Director  
National Environmental Engineering  
Research Institute  
Nehru Marg  
Nagpur - 440 020

Mr B Vijayaraghavan IAS (Retd.)  
Chairman  
Chennai Snake Park  
Raj Bhavan Post  
CHENNAI - 600 022

Mr R Rajamoni IAS (Retd)  
8-2-585/A/1 Road No.9  
Banjara Hills  
Hyderabad - 500 034

Mr N R Krishnan IAS (Retd)  
2<sup>nd</sup> Floor  
18 Balaji Nagar, 2<sup>nd</sup> street  
Royapet  
Chennai- 600 014

Mr T K A Nair IAS (Retd)  
Member  
Public Enterprise Selection Board  
Public Enterprise Bhawan  
Block No 14, CGO Complex  
New Delhi - 110 003

Dr A Abdul Kareem  
Vice Chancellor  
Tamil Nadu Agricultural University  
Coimbatore - 641 003

Dr K K Tiwari, Ex-Director  
Zoological Survey of India  
B - 278 Shalaguna  
Bhopal - 462 016  
Madhya Pradesh

Mr Samarsingh IAS  
Secretary General  
Worldwide Fund for Nature - India  
172-B, Max Muller Marg, Lodi Estate  
New Delhi 110 003

Mr N D Jayal IAS (Retd)  
Co-ordinator  
The Himalaya Trust  
274/II, Vasant Vihar  
Delhi Dun - 248 006

Prof Shekhar Singh  
Indian Institute of Public Administration  
Indraprastha Estate  
New Delhi - 110 002

Mr Aashbeesh Pitie  
'Bird Watchers' Society of Andhra Pradesh  
8-2-545 "Prem Parvat"  
Road No 7, Banjara Hills  
Hyderabad - 500 034

Mr Ramachandra Raja  
Wildlife Association of Ramnad District  
58 PSK Nagar  
Rajapalayam - 628 108  
Tamil Nadu

Dr (Mrs) Priya Davidar  
Salim Ali School of Ecology  
Pondicherry University  
R V Nagar, Kalapet,  
Pondicherry - 605 014

Mr P Kannan  
C-2A, Rajaji Bhawan  
Besant Nagar  
Chennai - 600 090

Mr S A Hussain  
Hussain Manzil  
Anakera Road  
Karkala - 574 104  
Karnataka

Dr Ashish Kothari  
Kalpavriksh, Apartment-5  
Shri Dutta Krupa  
908 Deccan Gymkhana  
Pune - 411 004

Dr A N D Nanavati  
C/o. S Nanavati  
Sundervan Flat  
Rasala Marg  
AHMEDABAD - 380 006

Mr Lavkumar Kacher  
14 Jayant Society  
Rajkot - 360 002  
Gujarat

Mr Prakash Gole  
Ecological Society  
I/B Abhimanshree Housing Society  
Off: Pashan Road  
Pune - 411 008

Dr Robert B Grubb  
Joy Home, Viagappar Road  
Christopher Nagar  
Pervilai - 629 201, Nagarcovil  
KK District, Tamil Nadu

Mrs Tara Gandhi  
Indian Institute of Public Administration  
Indraprastha Estate  
New Delhi - 110 002

Mr Digvijay Singh  
'The Palace'  
WANKANER - 363 621  
Gujarat

Mr Bittu Sahgal  
Sanctuary Asia  
602, Maker Chambers  
V Nariman Point  
Bombay- 400 021

Mr Zafer Futehally  
No.2205 Oakwood Apartments  
Jakkasandra Layout  
Koramangla, 3<sup>rd</sup> Block, 8<sup>th</sup> Main Road  
Bangalore - 560 034

Dr V S Vijayan  
Director & Member Secretary  
Salim Ali Centre for Ornithology and-  
Natural History  
Moongilpallam, Azhikatty  
Coimbatore - 641 108



Dr (Mrs) Lalitha Vijayan  
Principal Scientist  
Salim Ali Centre for Ornithology and  
Natural History  
Moongilpalam, Anaikatty  
Coimbatore - 641 108

Dr P A Azeez  
Principal Scientist  
Salim Ali Centre for Ornithology and  
Natural History  
Moongilpalam, Anaikatty  
Coimbatore - 641 108

**SALIM ALI CENTRE FOR ORNITHOLOGY AND NATURAL HISTORY, ANAIKATTI, COIMBATORE**  
**RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31 MARCH 1999**

Up to 31.03.99	Receipts		Current Year ended 31.03.99		Up to 31.03.98		Payments		Current year ended 31.03.99
	Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. P.
							By Revenue Expenditure		
							Salaries & Wages (Sch.1)	4981050.00	
							Travelling Expenses	311514.50	
							Contingencies	81216.00	
31109.64		17549.08					Rent	10625.00	
44125.46		1666583.07					Postage & Telephones (Sch.2)	125997.30	
5000.00		6000.00	1008437.04				Electricity Charges	91687	
0.00			4000000.00				Printing & Stationery (Sch.3)	73001.60	
17500000.00							Vehicle Maintenance (Sch.4)	175067.52	
							Reports & Publications	81216.00	
							Wages	72433.00	
							Watch & Ward Expenses	15438.00	
							Extension Programme	42573.00	
226077.00		76276.08					Audit fees (Sch.5)	11500.00	
386387.26		243219.63					Other when charges (Sch.6)	4344.00	
4274.30		3384.70					Equipment Maintenance	74181.25	
1472.06		148.00	313200.33				Miscellaneous Expenses (Sch.7)	159488.39	
							Recruitment Expenses	77342.00	

Up to 31.03.58	Re. P.	Receipts	Rs. P.	Current Year ended 31.03.59	Up to 31.03.58	Payments	Rs. P.	Current year ended 31.03.59
		To School of Advanced Management						
1140700.00		Advances/Deposits (Sch 12)	201140.00					
2040.00		Treasury Advances	2540.00					
61700.00		Gifts on salaries	318538.00					
8874.00		Professional Tax	9684.00					
835683.00		CPIF liabilities	834567.00					
840.00		Group Insurance	0.00					
6251.00		PIDA recovery	0.00					
154038.00		FDIs on external	77831.00					
		Amount recd. from creditors for						
17948.00		payment to RCHC	32797.00					
53051.00		To Members' Research Workshops Projects (Sch 12)						
7381.00		To Audit fees reimbursed by projects						
1501.00		To Refund of unspent advances by Dr. Bhai Sahasrabudhe						
49654.00		To amount reimbursed by PACORC						

Up to 31.03.98	Receipts		Current Year ended 31.03.99	Up to 31.03.98	Payments	Current year ended 31.03.99
Rs. P.		Rs. P.	Rs. P.	Rs. P.		Rs. P.
0.00	To Refund of loan by Bangalore Project					
0.00	To Loan received from PASOC		100000.00			
	To refund of loan by		250000.00			
9200.00	M/sign Bangalore Reserve	0.00		0.00		
7500.00	Endemic Liab	0.00		50171.00	Expenditure under projects (Sch.8)	250000.00
230000.00	PASOC	0.00		25000.00	Advance for Projects (Sch.9)	60000.00
				18660.00	Advance Deposit (Sch.10)	30000.00
				3000.00	Federal Advance	4500.00
				170000.00	Mobilization advance to COST (FOUR)	0.00
					Advance to COST (FOUR) for procurement	
				507470.00	of materials	317994.00
				400000.00	Short-term Fixed Deposit	0.00
					By loan to	
				9200.00	M/sign Bangalore Reserve	0.00
				7500.00	Endemic Liab	0.00
				210000.00	PASOC	0.00
					By Recoveries & Recoveries	
				91700.00	TDS on salaries	510516.00
				8570.00	Professional Fee	9000.00
				975085.00	Contingency Provision Fund	834387.00

Up to 31.03.98	Receipts	Current Year ended 31.03.98	Up to 31.03.98	Payments	Current year ended 31.03.98
Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. P.
			840.00	Group Insurance	0.00
			6251.00	PBA	0.00
			159814.00	TFR on pension	77580.00
			17940.00	Amounts received by ITOFC on behalf of employees	32797.00
			41056.92	Amount transferred to PISA	0.00
				By Closing Balance	
			17768.98	SRU Member SRU A/c	0.00
			1886608.05	SRU Contribution SRU A/c	664222.78
			8000.00	Cash on Hand - Import balance	18005.00
			0.00	Current Bank, Audit fees	12103.00
<b>31142142.66</b>		<b>17925894.34</b>	<b>21182142.66</b>		<b>986325.78</b>
					<b>17925894.34</b>

Prize: Contribution-100  
Date: 18 September 1999

Examined with the books and found correct  
Per M/S S. S. Jagadeesh & Associates  
Chartered Accountants

(Sd/-)  
Finance Officer

(Sd/-)  
A. S. Jagadeesh  
Partner

(Sd/-)  
Director



## Schedule LC Receipts &amp; Payments for the period ended 31.3.1999

Period ended 31.3.1998	Particulars	Period ended 31.3.1999
Rs. Pk.		Rs. Pk.

**SCHEDULE 1. SALARIES & ESTABLISHMENT EXPENSES**

836244.00	Pay of Officers/Establishment	2397441.00
1213464.00	Dearness Allowance	528244.00
143559.00	House Rent Allowance	138892.00
16054.00	City Compensatory Allowance	2492.80
3250.00	Composite Hill Allowance	1800.00
187901.00	Interim Relief	14741.00
21220.00	UTC Allowance	420.00
12215.00	House	10402.00
47319.00	Interest on CDF	72493.00
36402.00	Medical Reimbursement	56109.00
3967.00	Earned leave encashment	0.00
16810.00	Overtime Allowance	21550.00
12980.00	Arrears of Dearness Allowance	82222.00
4231.00	Leave Salary & PF	0.00
179278.00	CDF Contribution of SACOR	385644.00
0.00	Vth Pay Commission Arrears	1308553.00
0.00	Transport Allowance	8604.00
2699195.00		4981059.00

**SCHEDULE 2. POSTAGE & TELEPHONE**

37820.75	Postage Expenses	39267.75
128228.00	Telephone Charges	95325.05
176048.75		125682.80

**SCHEDULE 3. PRINTING & STATIONERY**

13578.00	Printing & Binding	33430.00
22048.10	Stationery - Office	43531.65
37628.10		73001.60

**SCHEDULE 4. VEHICLE MAINTENANCE**

87381.70	Fuel to Jeep	55873.02
79101.90	Repairs/Service/Insurance	423990.50
493.00	Bicycle Repair	0.00
3700.00	Rent/Bates & Taxes	0.00
150566.60		179863.52

**SCHEDULE 5. AUDIT FEES**

16500.00	Audit Fees	12500.00
11605.00	Internal Audit Fees	1000.00
28135.00		13500.00

**SCHEDULE 6. Other Administrative charges**

2010.00	Accountancy charges	0.00
14725.00	Legal Fees	4544.00
17735.00		4544.00

Period ended 31.3.1998 Rs. Pcs.	Particulars	Period ended 31.3.1999 Rs. Pcs.
---------------------------------------	-------------	---------------------------------------

#### SCHEDULE 7. MISCELLANEOUS EXPENSES

2169.00	Miscellaneous Expenses	37397.50
300.00	Xerox Charges	6155.15
1435.25	Local Travel	5414.75
85.00	Film Processing Charges	0.00
30.00	Railway Freight	1103.00
2401.00	Subscription to Newspapers	2238.00
14995.00	Water Charges	2220.00
0.00	Gardening and Office Furnishing	12205.00
290.00	Bank Charges	2935.00
1501.25	Refreshment/Lunch	5189.70
478.00	Liveries	478.00
4566.45	Other Miscellaneous Consumables	39723.65
14885.75	RAC Meeting	6921.00
0.00	Shifting Expenses	13047.00
1556.75	Repairs & Maintenance of Buildings	0.00
0.00	Uniform	2336.00
3526.40	Fuel for Generator	2378.64
0.00	Advertisement (Others)	2700.00
<u>30439.35</u>		<u>155408.39</u>

#### SCHEDULE 8. ADVANCE/EXPENDITURE UNDER PROJECT/WORKSHOPS

0.00	Meeting on Wildlife Research	37125.00
2744.00	Documentation	2146.00
500.00	Advance to Dr F Balasubramanian	0.00
12352.00	BNHS Corridor	105.00
2000.00	Advance to Dr N Sivaganesan	0.00
24577.00	Bike-horn Swiftlet	267.00
0.00	Elephant Census	24941.00
<u>50173.00</u>		<u>64675.00</u>

#### SCHEDULE 9. ADVANCE TO PROJECT/OTHERS

10000.00	Dandakpur National Park	0.00
15000.00	Naxos Interpretation Centre	0.00
0.00	Wifaloo of Andaman	45980.00
0.00	Small Carnivores	35000.00
<u>25000.00</u>		<u>60980.00</u>

#### SCHEDULE 10. ADVANCE/DEPOSIT

3400.00	Electricity Deposit	1250.00
0.00	Telephone- DIT	6900.00
9000.00	Advance to Dr E S Prasad	10000.00
6000.00	Advance to Dr E Johnson	0.00
0.00	Medical Adv. to Dr N. Sivaganesan	17070.00
0.00	Advance to Dr. N. Sivaganesan	4112.00
0.00	Advance for Water Cooler	18908.00
0.00	Advance to CAT Industries	26052.00
0.00	EE Charges paid on behalf of COSTFOOD	10448.00
0.00	LTC Advance to Dr. N. Sivaganesan	1800.00
0.00	Advance to Sanction Sec. Service	3900.00
<u>18400.00</u>		<u>105090.00</u>

Period ended	Particulars	Period ended
31.3.1999		31.3.1999
Rs. Pk.		Rs. Pk.

#### SCHEDULE 11. INSTITUTIONAL CHARGES RECEIVED FROM PROJECTS

126870.00	EIA Study	6650.00
16810.00	People Participatory Approach	0.00
0.00	Pesticide Contamination	10000.00
7000.00	Small Carnivores	0.00
4000.00	Fragmented Rain Forest	0.00
30000.00	Wildlife of Andaman	0.00
4000.00	Limnecology & Phytochemistry	0.00
16897.00	Sea Grass - UNESCO	0.00
0.00	Rapid Assessment of Bio-Diversity	29886.00
228977.00		76516.00

#### SCHEDULE 12. RECOVERIES OF ADVANCES/DEPOSITS

70000.00	EIA Study	0.00
64000.00	Telephone Deposit	0.00
810000.00	Mobilization Advance	260000.00
106700.00	EMO and Security Deposit on Road & Fencing	0.00
0.00	GOB Security	3150.00
1103700.00		263150.00

#### SCHEDULE 13. RECEIPT TOWARDS PROJECTS/WORKSHOPS

10000.00	Documentation - T.N. Forest Dept.	0.00
15000.00	88MS Elephant Corridor	0.00
29953.00	Edible-nest Swiftlet from WWF	0.00
0.00	Elephant Census - T.N. Forest Dept	25000.00
29953.00		25000.00

**SALZHO ALI CENTRE FOR AGNITHOLOGY AND NATURAL HISTORY, ANAKKATTU, COIMBATORE**  
**INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 MARCH 1999**

UP TO 31.03.98	EXPENDITURE	LIABILITIES YEAR ENDED 31.3.99	LP TO 31.03.98	INCOME	CURRENT YEAR ENDED 31.03.99
R. P.		To P.	R. P.	By Income	R. P.
2705445.00	Salaries & Emoluments	4681051.00			
517791.40	Travelling Expenses	331514.50			
436.00	Contributions	81435.00	228877.00	Interest Charges (Sub.11)	9636
65900.00	Post	37400.00	386387.26	Interest received	295219.61
176248.75	Postage & Telephones (Sub.2)	125692.30	4274.50	Miscellaneous receipt	3594.7
76649.00	Electricity Charges	91687.00	1472.00	Vehicle hire charges	140
37626.10	Printing & Stationery (Sub.3)	3300.00	3157182.44	By excess of expenditures over income	657987.23
159668.60	Vehicle Maintenance (Sub.4)	178667.32			
0.00	Repairs & Publications	81220.00			
28941.50	Wages	72433.00			
54000.00	Water & Fuel Expenses	15000.00			
3774.00	Excursion Programme	42571.00			
24873.00	Audio Visual fees (Sub.5)	4076.00			
91359.10	Equipment Maintenance	94181.25			
20439.35	Minor Repairs Expenses (Sub.7)	175498.79			
56812.40	Reimbursement Expenses	72342.00			
108848.00	Vehicle Hire Charges	375661.00			
4250.00	Honourarium Expenses	3051.00			

UP TO 31.03.98	EXPENDITURE	CURRENT YEAR ENDED 31.1.99	UP TO 31.03.98	INCOME	CURRENT YEAR ENDED 31.03.99
Rs. P.	Rs. P.	Rs. P.	Rs. P.		Rs. P.
5627.00	Insurance Premium	18648.00			
17712.00	Other admin charges (Rs. P.)	4544.00			
2034.00	Annual report Transactions	2609.00			
4178203.20		6648287.56	4178250.28		6948287.56

Place: Calicut 10/08  
Date: 2 September 1999

Examined with the books and found correct

For Mrs. A. S. Regalado & Associates  
Chartered Accountants

(Sd/-)  
Francis Dilsaor

(Sd/-)  
A. S. Regalado  
Partner

(Sd/-)  
Director





Up to 31.3.98	Liabilities		Current year ended 31.3.99	Up to 31.3.98	Asset	Current year ended 31.3.99
Rs. Ps.		Rs. Ps.	Rs. Ps.	Rs. Ps.		Rs. Ps.
106700.00	Road and fencing		106700			
0.00	TDS Payable		442		Vehicles	
					Jeeps	571190.00
					Cycles	2570.00
805967.20	Retention Money Deposits (CDs/TFDs)		515023		Other machines	
0.00	Retention Money on Road & Fencing		88997		Xerox Machine	13117
					844 Address during the year	12613
						29870
					Less: Additions during the year	13117
						123613
					Capital Fringe	
					Furniture & Fittings	12235
					Opening Balance	61459.40
					Add: Additions during the year	435766.00
					Library Books	
					Opening Balance	402237.35
					Add: Additions during the year	1026426.00
					Total Provision	3082963.35
						4070

Up to 11.3.08	Contribution	Current year ended 11.3.09	Up to 11.3.08	Assets	Rs. Pk.	Current year ended 11.3.09
Rs. Pk.	Rs. Pk.	Rs. Pk.	Rs. Pk.			Rs. Pk.
				CAPITAL WORKS-IN-PROGRESS		
			3479915.55	Buildings under construction	8926240.05	
			7446204.50	Add: Additions during the year	4085497	
			8926240.05		13011717.05	
				Less: Transferred to Buildings A/c	10217275	3094962.05
			0.00	Compucon		653344
				Investment		
			4000000.00	Short-term Fixed Deposit with Bank		0.00
				DEPOSITS, LOANS AND ADVANCES		
			1440.00	Federal Advance	2700.00	
			10950.00	Rent Advance	4000.00	
			0.00	Electricity Deposit	19925.00	
			110156.00	Other Advances Deposits	343721.00	
				(Deposits as per Schedule B)		
			1200000.00	COSTFORD Mobilisation Advance	940000.00	
			567470.00	Advance to CDDT/FORDS for Materials purchase	707994	
			1000764.00			1340070.00
			20000	Loan to SACON Res. Fellow Award		0.00
			0.00	Proposed Expenses		23142.00

Up to 31.3.98	Liabilities		Current year ended 31.3.99	Up to 31.3.98	Assets		Current year ended 31.3.99
Rs. Ps.		Rs. Ps.	Rs. Ps.	Rs. Ps.		Rs. Ps.	Rs. Ps.
					CASH & BANK BALANCES		
					State Bank of India Co. A/c		
				13564.98	- Mumbai	0.00	
				(880488.01)	- Corbinine	664232.26	
				0.00	Central Bank, Amritsar	(2167)	
				8009.06	Cash on hand - Imperial balance	35000	
				1908457.81			986129.78
332344601.40			36271223.17	35249601.40			36271221.17

Place: Chandigarh-160  
Date: 18 September 1999

Submitted with the books and found correct  
For M/s A.S. Jagdishsingh & Associates  
Chartered Accountants

(Sd/-)  
Finance Officer

(Sd/-)  
A.S. Jagdishsingh  
Partner

(Sd/-)  
Director

**Schedule to Balance Sheet as at 31.03.1999**

Period ended	Particulars	Period ended
31.3.1999		31.03.1999
Rs. P.		Rs. P.

**Schedule A. Other Liabilities towards Workshops/Projects**

71929.00	Meeting on Wildlife Research on South Zone	34304.30
13354.50	Lead Use and Biodiversity Conservation Seminar	13259.50
25452.00	Preparation of material for Economic Development	25452.00
1048.00	Swifter Project II	1281.00
110.00	Red Data Book Meeting	110.00
2758.00	Documentation - WWF	610.00
482.00	WWF Corridor	543.00
0.00	Elephant Census	33.00
<b>117307.00</b>		<b>77692.80</b>

**Schedule B. Details of other Advances/Deposits**

3500.00	National Remote Sensing Agency	3500.00
2120.00	GDA Security Pvt Ltd.	0.00
250.00	M/s Rajaji Gas Agencies (Deposit for Prima Gas)	250.00
18784.00	TKR Security Deposit	0.00
8680.00	Indian Oxygen Ltd. (Deposit for cylinders)	8680.00
1801.50	OCL - Deposit for Gas Cylinders	1800.00
3146.10	Amount spent in advance for projects	3146.00
10175.00	Advance to Mr. D. Joseph	10175.00
540.00	Amount receivable from Dept. of Science & Tech.	550.00
8000.00	Telephone Deposit (Hes. DTT)	10000.00
16000.00	Telephone Deposit (DIT)	16200.00
6000.00	Advance to Dr. K. Johnson	6000.00
9000.00	Advance to Dr. S. Prasad	18000.00
18000.00	Advance to Bandipur Project	0.00
15000.00	Advance to Nature Interpretation Centre	15000.00
0.00	Medical Advance to Dr. N. Sivaganesan	17076.00
0.00	Advance to M/s. Scripless Security	5900.00
0.00	ATC Advance to Dr. N. Sivaganesan	3800.00
0.00	Advance to Dr. N. Sivaganesan	4112.00
0.00	Advance for Water Cooler	18500.00
0.00	Advance to Aravind Project	45880.00
0.00	Advance to Small Enterprises	25000.00
0.00	ED charges paid on behalf of children	10444.00
0.00	Advance to GSI Foundation	28000.00
<b>110336.00</b>		<b>243321.00</b>



**SALIM ALI CENTRE FOR ORNITHOLOGY AND NATURAL HISTORY, ANAIKATTY, COIMBATORE**  
**CONSOLIDATED RECEIPTS & PAYMENTS ACCOUNT FOR THE YEAR ENDED 31 MARCH 1999**

Up to 31.03.98	Receipts	Current year ended 31.03.99	Up to 31.03.99	Payments	Rs.	Pcs.	Current year ended 31.03.99
Rs.	Pcs.	Rs.	Pcs.		Rs.	Pcs.	Rs.
95947.58				By Revenue Expenditure			
	To Opening Balance b/d	134710.16		Salaries & Wages	526791.00		
	To Grant Received during the year			Travelling Expenditure	192612.90		
				Expensables	50661.25		
21600.00	Fragmented rain forest	0.00		Contingencies	9714.40		
50000.00	Ethnoscology	0.00		Other Project Cost	58471.05		
50719.00	Pesticide	177740.00		Medical Expenses	100216.00		
190000.00	Activities of Amphibian	0.00		Workshop Expenditure	850.00		
60000.00	Sand Crayons	0.00		Staff Inc. Cost	22460.00		
28138.15	Lower Terrace	0.00		Interest on Charges	76536.00		
125810.00	People Participatory Approach	0.00					
675400.00	Preservation of endangered species	0.00					
96136.00	Acquisitance	280251.00		By Capital Expenditure			
32107.99	SALIM FIDA	0.00		Purchase of Fixed Assets/Equipment			
28923.00	Edible seed Storage	0.00					87791.00
0.00	Signet Display: Reserve	175000.00					
0.00	Rapid Assessment	126842.00					
0.00	Conservation planning	50173.00		By acquisition of land on project SALIM			10000.00
740560.00	To Creditors Income	202500.00		By advances to B&B			40600.00



**SALIM ALI CENTRE FOR ORNITHOLOGY AND NATURAL HISTORY, ANAKKATTI, COIMBATORE**  
**CONSOLIDATED INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 MARCH 1999**

Up to 31.03.98	Expenditure	Current year ended 31.3.1999	Up to 31.03.98	Income	Current year ended 31.3.1999
Rs. P.		Rs. P.	Rs. P.		Rs. P.
	To Revenue Expenditure			To Income	
667768.00	Salaries & Wages	556783	65491.23	Interest received	85037.99
65425.66	Expenditure	60400.25			
484705.00	Travel/Vehicle expenses	309864.9	159499.42	By status of expenditure over income	1009035.61
249919.05	Office Project Cost	36252.09			
17635.66	Contingencies	10800.4			
228977.00	Interest on deposits	76556			
0	Workshop Expenses	1917			
0	Medical Reimbursement	10218			
0	Swachh Dora	22460			
1638259.05		1105301.00	1658429.65		160501.66

Examined with the books and found correct

For Mr. A. S. Sankaranarayanan & Associates  
Chartered Accountants

(Sub-  
NS for 1999-  
2000)

(Sub-  
Director

Place: Coimbatore-1108  
Date: 8 September 1999

(Sub-  
Finance Officer

**SALIM ALI CENTRE FOR ORNITHOLOGY AND NATURAL HISTORY, ANAIKATTY, COIMBATORE**  
**CONSOLIDATED BALANCE SHEET AS AT 31 MARCH 1999**

Up to 31.03.98	Liabilities	Current year ended 31.03.99	Up to 31.03.98	Assets	Current year ended 31.03.99
Rs. Ps.		Rs. Ps.	Rs. Ps.		Rs. Ps.
	<b>PROJECT FUND</b>				
2308703.22	Opening Balance as per last year Balance Sheet	2308805.94	1374717.15	Fixed Assets (at cost)	1426531.35
1956147.01	Add Grant received during the year	815116.00	91614.66	Equipment	87584.00
748880.10	Consistency Income	294666.00	142631.35	Add Additions during the year	1513942.35
4992855.32		4418571.90	0.00	Less Cost of equipment maintained	1565.00
1594929.42	Less: Excess of expenditure over income	1048937.91	142631.35		1512356.35
3100895.90					
40000.00	Grant received from SACON		84766.89	Computer	64756.00
0.00	Amount due to Mr. Mangaraj	69780.04	492233.59	Advance to Zoo Outreach Org.	922548.39
8200.00	Grant received from Dr. (Mrs.) L. Madhavan	4.00	10000.00	Deposits - Telephone	10000
		8290.00	2000.00	SMIT	7000
			0	Prepaid Expenses	7500
			0	TDS (A.Y. 1998-2000)	2500
			87586.00	Advance to (R.V.P)	86790
			6.00	Loan to SACON	250000
			6.00	Advance to RRBSC	10000
				Bank Balance	

Up to 31.03.98	Liabilities	Current year ended 31.03.98	Up to 31.03.98	Amount	Current year ended 31.03.98
Rs. Pcs.		Rs. Pcs.	Rs. Pcs.		Rs. Pcs.
			(154210.16)	State Bank of India (SBI A/c)	965303.55
				R/S Union Contribution	
1417005.90		3437700.29	3417692.90		1407706.28

Examined with the books and found correct

For M/s A.S. Jayashankar & Associates  
Chartered Accountants

(Sd/-)  
Pranav Officer

(Sd/-)  
A.S. Jayashankar  
Partner

(Sd/-)  
Director